Table of Contents | List of Traffic Control Typicals

WORK ZONE TRAFFIC CONTROL

MAINTENANCE

MDOT
Michigan Department of Transportation

GUIDELINES

Maintenance Support Area

October 2004

Table of Contents

Appendix A

List of Traffic Control Typicals

Introduction

Temporary signing is a very important part of any maintenance operation. The purpose of this manual is to provide guidance for the placement of temporary signing in maintenance work zones.

If in the use of these guidelines you have questions or come across items that should be included or need modification contact the Region Support Unit of the Maintenance Division at 517-322-3300.

Traffic Control Plans

Traffic control plans typical to most maintenance operations are shown on pages 9 to 34. These standard plans should be used as guidelines for the layout of traffic control devices within work zones. Job and traffic conditions may warrant modification of these plans or the use of traffic control measures not shown within these guidelines. If you feel the need to modify one of these guides, please contact your local TSC or Region Traffic office.

General Signing Guidelines

For "Long Term Stationary" closures in non-pedestrian areas a five (5) foot bottom height is required and driven posts are suggested. In pedestrian areas seven (7) foot bottom height is required.

For visibility, signs should be placed within six (6) to twelve (12) feet of the edge of the traveled lane or no closer than two (2) feet to the back of curb.

Existing permanent signing in the work zone which conflicts with maintenance signs shall be covered during the work operation and shall be restored to normal when the work operation ceases. Signs shall be covered so that the reflective material is not damaged. One example of how to cover a sign is given on page 33.

Temporary signing shall be covered or removed when the work operation ceases (this is the source of most signing complaints). If a work zone is left unattended for any reason, all reduced speed signs, less than 60 mph, shall be turned away from traffic, unless it is determined that a lower speed limit must remain in place to maintain work zone safety/integrity.

It is suggested that drums be used in long-term stationary and intermediate-term stationary work zones, instead of cones. Cones and drums should not be mixed within work zones.

END ROAD WORK (G20-2) signs shall be used in all cases if the duration of a work zone is long-term stationary, intermediate-term stationary and short-term stationary.

It is important that the work zone be driven on a daily basis to ensure that the motorist will not be confused by the signing sequence and that all lighted arrows are aimed correctly.

Warning Signs

- The minimum size of all diamond shaped warning signs is 48" x 48".
- Reflectorized signing is required, unless the Region/TSC approves daytime use of alternate signing.
- All warning signs may be equipped with an orange or day-glo flag mounted above the sign.
- Type A warning lights will not be required with the use of roll-up signs.
- The **"advance signing sequence"** consists of three signs; ROAD WORK AHEAD (W21-4), INJURE/KILL WORKER (R5-18b) and TRAFFIC FINES DOUBLED (R5-18). Refer to page 34 for proper signing sequence.

Sign Spacing – "D" Distances

The spacing between signs is based upon the permanently posted roadway speed. The sign spacing distances are approximate and may be adjusted to meet changing roadway and traffic conditions.

Table 1. Sign Spacing ("D" Distances)

Speed (mph)	Distance (ft.)	Speed (mph)	Distance (ft.)
25	250	50	500
30	300	55	550
35	350	60	600
40	400	65	650
45	450	70	700

Tapers – "L" Lengths

Whenever tapers are to be used near interchange ramps, crossroads, curves, or other influencing factors, it may be necessary to adjust the length of tapers, or extend the lane closure so the taper can be established in advance of these factors. Recommended minimum values for taper lengths, "L", are shown in Table 2.

Table 2. Taper Lengths

Taper Length, L (ft)		Posted Speed Limit, mph (Prior to Work Zone)									
		25	30	35	40	45	50	55	60	65	70
Offset / Lane Width (ft)	8	83	120	163	213	360	400	440	480	520	560
	9	94	135	184	540	405	450	495	540	585	630
	10	104	150	204	267	450	500	550	600	650	700
	11	115	165	225	293	495	550	605	660	715	770
	12	125	180	245	320	540	600	660	720	780	840
	13	135	195	266	347	585	650	715	780	845	910
	14	146	210	286	374	630	700	770	840	910	980
	15	157	225	307	400	675	750	825	900	975	1050

Cone and Drum Spacing for Channelization

Spacing of channelizing devices in feet in the taper area should not exceed the posted speed in miles per hour and twice the speed in the parallel area (e.g., a 45 mph posted speed road should normally have devices spaced no greater than 45 ft apart in the taper area and 90 ft in the parallel section). Cones or drums on a tangent, to keep traffic out of the closed lane, should be spaced in accordance with the extent and type of activity, the speed limit of the roadway, and the vertical and horizontal alignment of the roadway. The spacing should be between 50 and 100 feet.

Arrow Panels

The Michigan Manual of Uniform Traffic Control Devices, states: "For stationary lane closures along a multilane roadway, the arrow display should be located on the shoulder at the beginning of the taper. Where the shoulder is narrow, the arrow display should be located in the closed lane."

Table 3. Arrow Display Types and Requirements

Panel Type	Minimum Size (ft)	Minimum Number of Lighted Elements
A	4 x 2	12
B	5 x 2.5	13
C	8 x 4	15

Type A arrow displays are appropriate for use on low-speed urban streets. Type B are appropriate for intermediate-speed facilities and for maintenance or mobile operations on high-speed roadways. Type C arrow displays are intended to be used on high-speed, high-volume traffic control projects.

An arrow display shall not be used on a two-lane, two-way roadway in the arrow mode. The panel shall display the caution mode (bar mode) when used on these roadways.

When maintaining a standard lane closure (example page 27 of guidelines), a Type C arrow panel should be used. When maintaining a standard lane closure with traffic regulators (example page 14 in guidelines), the arrow for the closed lane should be a Type C arrow. The arrow used for the active lane should be either a Type B or Type C.

See page (9) for correct alignment of arrow bars.

Shadow Vehicle

A shadow vehicle should be used for lane closures on all roadways which have 55 mph or greater posted speeds and two or more lanes in each direction. If there is not an 04 truck assigned to a crew and one cannot be obtained from an area garage, a smaller vehicle can be used with an increased roll-ahead space.

Shadow Vehicle continued…

A shadow vehicle may be used in other work zones as deemed necessary. Factors to be considered in determining need include the following:

- Time of day of the closure
- Seasonal variations in traffic volume
- Length of lane closure and anticipated duration
- Traffic speeds
- Frequency of traffic stopping/turning movements

The shadow vehicle should be a loaded 04 truck (23,000 GVWR or greater) with brakes set, front wheels turned away from traffic and parked at the beginning of the roll-ahead space.

The roll-ahead space is the space between the shadow vehicle and the work area. This additional space is needed only when a shadow vehicle is used.

Table 4. Guidelines for Roll-Ahead Space for Shadow Vehicles

Weight of Shadow Vehicle	**Prevailing Speed** (Posted Speed Prior to Work Zone)	**Roll-Ahead Space** (Distance From Front of Shadow Vehicle to Work Area)
10,000 lb (Stationary)	60-70 mph 50-55 mph 45 mph	100 ft 75 ft 50 ft
10,000 lbs (Moving[1])	60-70 mph 50-55 mph 45 mph	175 ft 150 ft 100 ft
15,000 lbs (Stationary)	60-70 mph 50-55 mph 45 mph	100 ft 75 ft 50 ft
15,000 lbs (Moving[1])	60-70 mph 50-55 mph 45 mph	150 ft 125 ft 100 ft
23,000 lbs (Stationary)	60-70 mph 50-55 mph 45 mph	100 ft 75 ft 50 ft
23,000 lbs (Moving[1])	60-70 mph 50-55 mph 45 mph	100 ft 75 ft 75 ft

[1] Distances are appropriate for shadow vehicle speeds up to 15 mph.

Truck Mounted Attenuators (TMAs)

It is suggested that a TMA be used anytime a shadow vehicle is deemed necessary.

Buffer Space

Buffer Space is an optional feature that separates traffic flow from the work activity. No equipment, materials or vehicles shall be stored in the buffer space. The shadow vehicle, if used, must be placed beyond the longitudinal buffer space.

Table 5. Buffer Space Length for Posted Speeds

Speed (mph)	Length (ft)	Speed (mph)	Length (ft)
20	33	50	279
25	50	55	329
30	83	60	411
35	132	65	476
40	181	70	542
45	230		

Partial Lane Closures

Partial lane closures shall be avoided. If any part of the lane is to be occupied, the whole lane should be closed. If the work within a closure moves more than two (2) miles from the original signing sequence, a new signing sequence should be set and the original removed.

Definitions

The following definitions are taken from the Michigan Manual of Uniform Traffic Control Devices.

6G-3 Duration of Work

Work duration is a major factor in determining the number and types of devices used in temporary traffic control zones. The duration of a temporary traffic control zone is defined relative to the length of time a work operation occupies a spot location. When any part of the roadway is obstructed or closed, for a short-term stationary work or longer, advance warning signs to alert traffic are required well in advance of these obstructions or restrictions. The five categories of work duration and their time at a location are as follows:

A. Long-Term Stationary — *Work That Continuously Occupies a Location More than Three Days.*

Long-term stationary temporary traffic-control zones require the use of a complete set of advance warning signs. There is ample time to install and realize benefits from the full range of traffic control procedures and devices that are available for use. Generally, larger channelizing devices are used, as they have more retro-reflective material and offer better nighttime visibility **(use drums or moveable barrier rather than cones)**. The larger devices are also less likely to be displaced or tipped over, an important consideration during those periods when the work crew is not present to maintain the zone. Furthermore, since long term operations extend into nighttime, retro-reflective and/or illuminated devices are required. Temporary roadways and barriers can be provided **(i.e. - use of an alternate roadway, or detour)**, and inappropriate markings should be removed and replaced with temporary markings **(remove or cover existing lane and other markings and replace with markings appropriate to the work zone)**

B. Intermediate-Term Stationary — *Work That Occupies a Location from Overnight to Three Days.*

Intermediate-term stationary work requires the use of a complete set of advance warning signs. It may not be feasible or practical to use procedures or devices that would be desirable for long-term stationary temporary traffic control zones, such as altered pavement markings, barriers, and temporary roadways. The increased time to place and remove these devices in some cases could significantly lengthen the project, thus increasing exposure time. In other instances, there might be insufficient pay-back to make more elaborate traffic control economically attractive.

C. Short-Term Stationary — *Daytime Work That Occupies a Location from One to Twelve Hours.*

Short-term stationary work requires the use of a complete set of advance warning signs. The work crew is present to maintain and monitor the temporary traffic control zone. The use of traffic regulators is a practical and available option. Lighting and /or retro-reflective devices should be incorporated to accommodate varying seasonal, climatic, and visibility situations.

D. Short Duration and Mobile Operations

As compared to stationary operations, short-duration and mobile operations are distinct activities that may involve different treatments. More mobile devices are needed (e.g., signs mounted on trucks), and larger, more imposing and more visible devices can be used effectively and economically. For example, appropriately colored and marked vehicles with flashing or rotating lights, perhaps augmented with signs or arrow panels, may be used in place of signs and channelizing devices. The trade-off is economical because work duration is short. Mobility is essential, the crew is always on-site, and some of the vehicles may be required for the work activity or crew transportation. Safety is not compromised, as numerous small devices are merely replaced by fewer more dominant and effective devices.

D-1. Short Duration — *Work That Occupies a Location up to One Hour.*

Short-duration activities are generally considered to be those where it takes longer to set up and remove the traffic-control zone than to perform the work. Typically, such operations can be accomplished in 60 minutes or less. **The work in such operations must be accomplished in 60 minutes or less at each location. The time required to set up and tear down required traffic control is not included in the 60 minutes.**

There is significant time exposure involved in the crew setting up and taking down the traffic controls. Also, since the work time is short, the time during which motorists are affected is significantly increased when additional devices are installed and removed. Considering these factors, it is generally held that simplified control procedures may be warranted for short duration activities. Such short comings may be offset by the use of other more dominant devices such as special lighting units on work vehicles. **(You may not need all of the signing and other devices shown for longer term set ups, but you need to ensure that traffic knows that something is going on and that they can see you.)**

D-2. Mobile — *Work That Moves Intermittently or Continuously.*

Intermittently moving mobile operations are work activities that often involve frequent short stops, each as much as 15 minutes long, for activities such as litter cleanup, pothole patching and sign installation. Warning signs, flashing vehicle lights, flags, and/or channelizing devices should be used. **(Make sure traffic knows what is happening and that they can see you.)**

Continuously moving mobile operations include work activities where workers and equipment move along the road without stopping, usually at slow speeds for such activities as street sweeping, mowing and pavement marking. The advance warning area moves with the work area. Warning signs, flags and channelizing devices may not be required. Flashing vehicle lights shall be used.

For intermittently moving and continuously moving mobile operations a minimum of a well-marked and well-signed vehicle with flashing rotating or strobe lights is required. A protection vehicle equipped as a sign truck, preferably supplied with a flashing arrow panel, should follow the work vehicle when traffic volumes, traffic speeds or visibilities dictate increased protection. Where feasible, warning signs should be placed along the roadway and moved periodically as the work progresses. In addition, vehicles may be equipped with flags, truck-mounted attenuators and appropriates signs.

It must be emphasized that safety should not be compromised by using fewer devices simply because the operation will frequently change its location. Portable devices should be used. Traffic Regulators may be used, but caution must be exercised so they are not exposed to an unnecessary increase in accident potential. The control devices should be moved periodically to keep them near the work area. If mobile operations are in effect on a high-speed travel lane of a multi-lane divided highway, flashing arrow panels should be used.

Revision: October 2004

TOC

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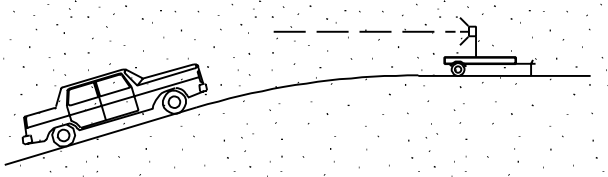

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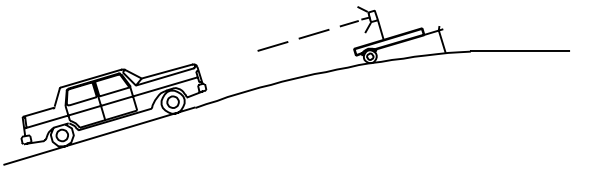

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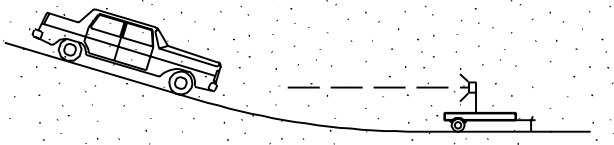

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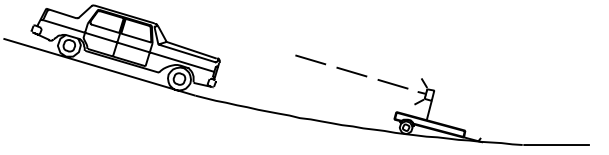

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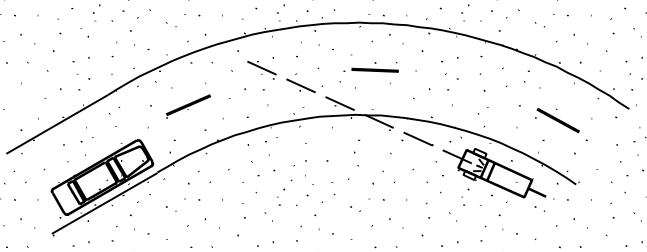

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NOTE:
EXERCISE CARE WHEN PLACING "LIGHTED ARROW" ON VERTICAL OR HORIZONTAL CURVES.
ADJUST ALIGNMENT OF "LIGHTED ARROW" TO ALLOW MAIN BEAM OF LAMPS TO BE SEEN BY DRIVER FOR MAXIMUM EFFECTIVENESS.

MDOT
Michigan Department of Transportation

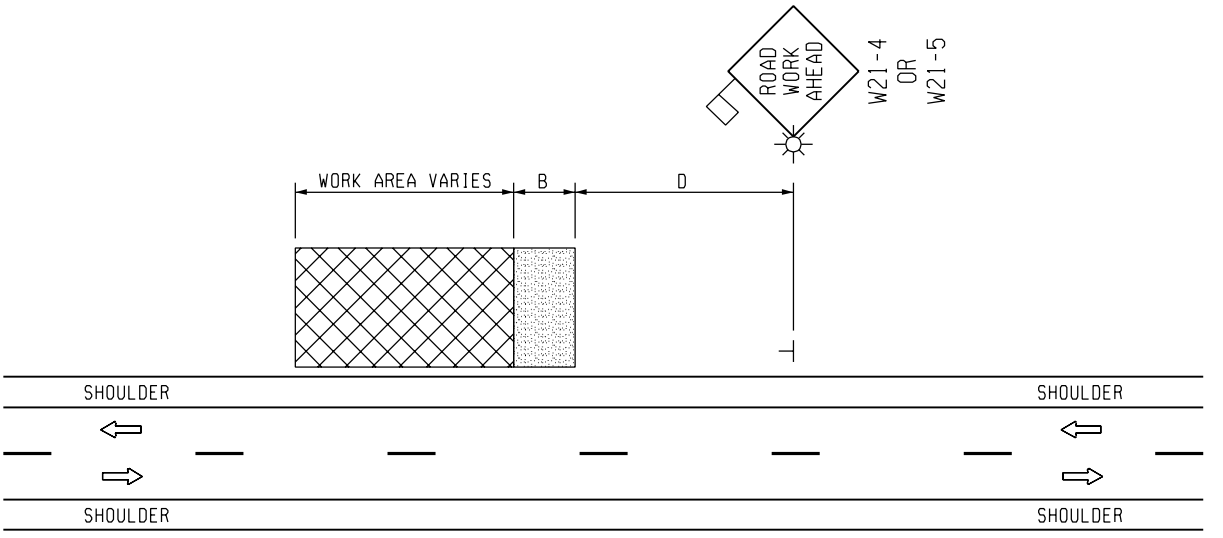
MAINTENANCE DIVISION

USE OF LIGHTED ARROW
ON A HILL OR CURVE

File: page9.dgn

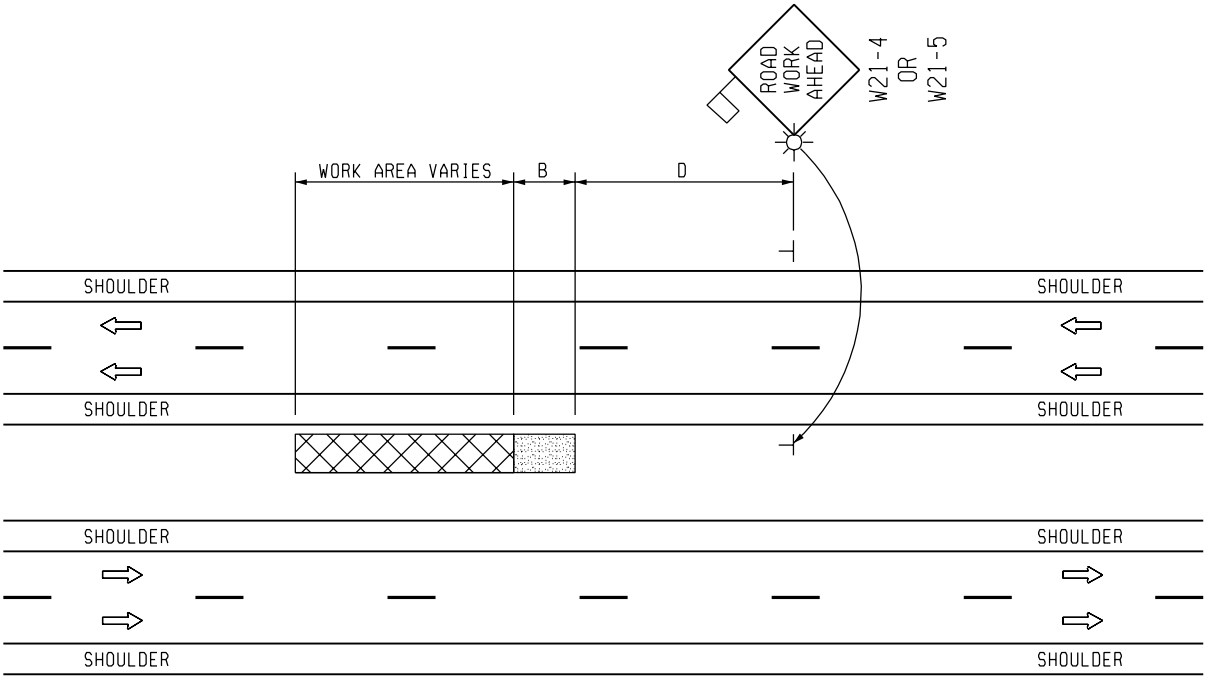
Drawn by:

Revision Date: 06-08-2004



NOTE:
NO SIGNS ARE REQUIRED IF DURATION IS SHORT-DURATION OR MOBILE.

IF THE OPERATION IS LONG-TERM STATIONARY, INTERMEDIATE-TERM STATIONARY, OR SHORT-TERM STATIONARY AND A VEHICLE(S) IS PARKED ON THE SHOULDER, TRAFFIC CONTROL SHOULD REFLECT A SHOULDER CLOSURE.



FLUORESCENT ORANGE WARNING FLAG (OPTIONAL)

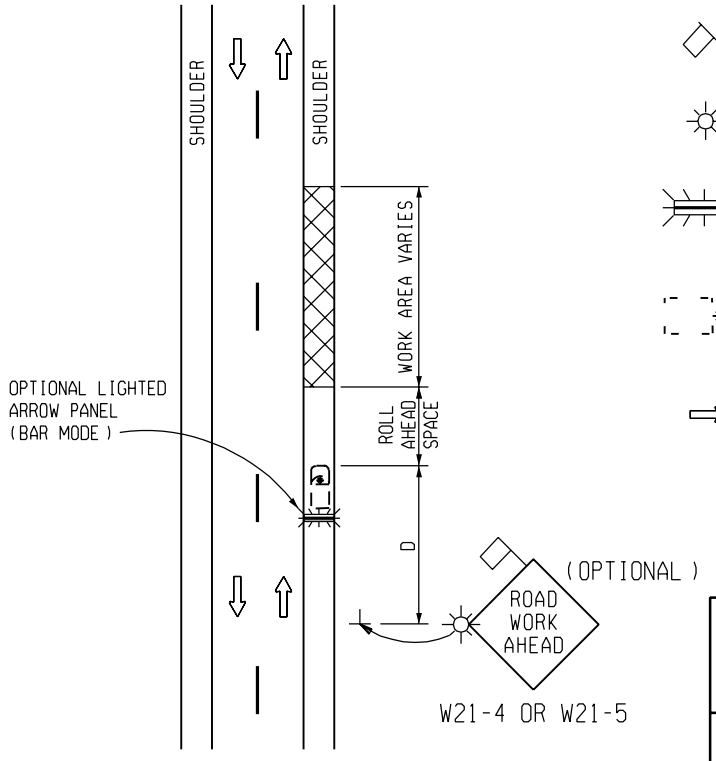
TYPE A WARNING FLASHER (REQUIRED ON PLYWOOD SIGNS)

DURATION: LONG-TERM STATIONARY, INTERMEDIATE-TERM STATIONARY, SHORT-TERM STATIONARY, SHORT DURATION, MOBILE

MDOT Michigan Department of Transportation
MAINTENANCE DIVISION

TRAFFIC CONTROL PLAN FOR WORK OUTSIDE OF SHOULDER

File: md13.dgn		MD-13	PAGE 10
Drawn by:	Revision Date: 06-08-2004		

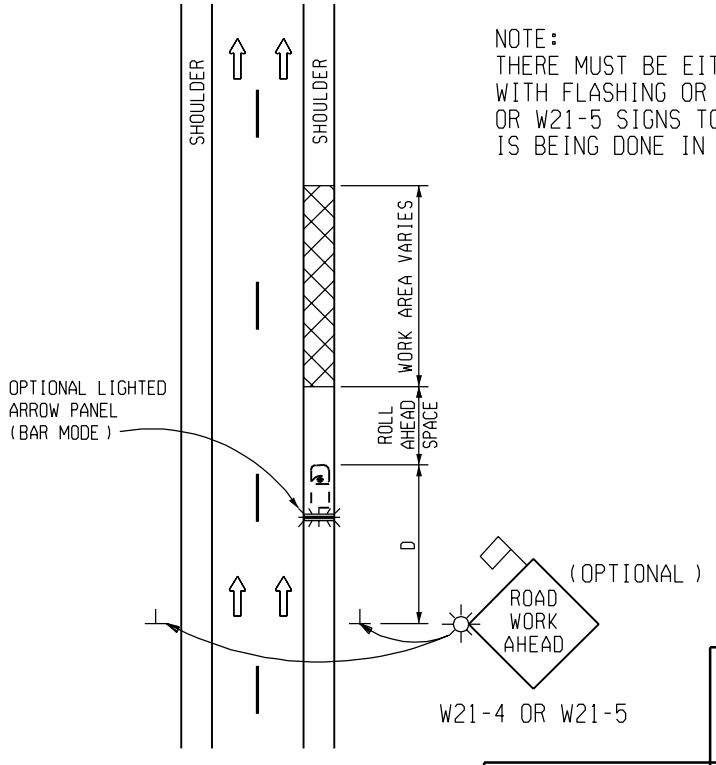


KEY

- FLUORESCENT ORANGE WARNING FLAG (OPTIONAL)
- TYPE A WARNING FLASHER (REQUIRED ON PLYWOOD SIGNS)
- LIGHTED ARROW PANEL (BAR MODE)
- OPTIONAL SHADOW VEHICLE WITH FLASHING OR ROTATING LIGHTS AND OPTIONAL TRUCK MOUNTED ATTENUATOR
- TRAFFIC FLOW

DURATION: SHORT-DURATION, MOBILE

TRAFFIC CONTROL PLAN FOR WORKING ON THE SHOULDER OF A TWO-LANE, TWO-WAY ROADWAY

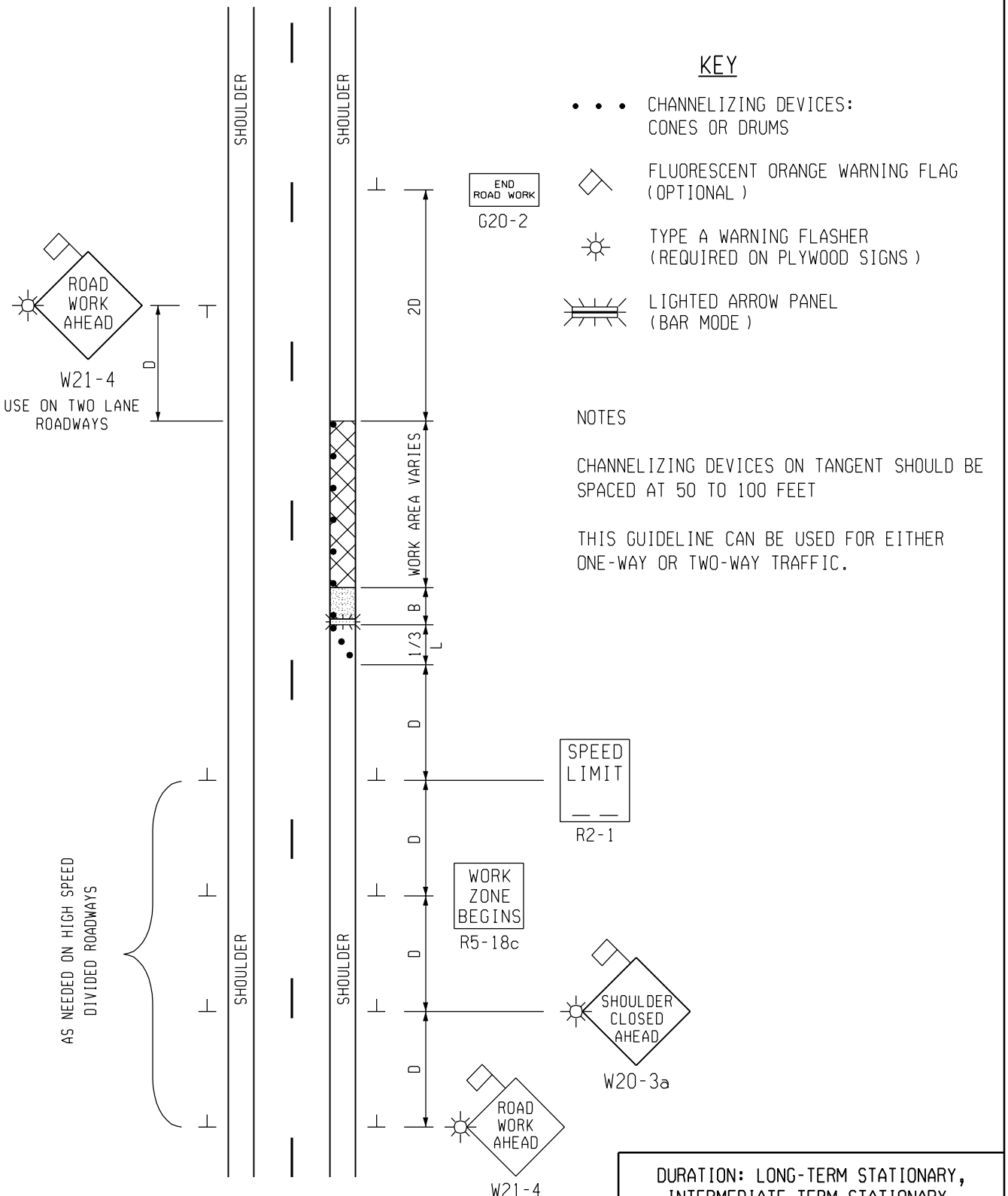


NOTE:
THERE MUST BE EITHER AN APPROPRIATELY MARKED VEHICLE WITH FLASHING OR ROTATING LIGHTS, OR OPTIONAL W21-4 OR W21-5 SIGNS TO INDICATE TO THE PUBLIC THAT WORK IS BEING DONE IN THE AREA

DURATION: SHORT-DURATION, MOBILE

MDOT Michigan Department of Transportation
MAINTENANCE DIVISION

TRAFFIC CONTROL PLAN FOR WORKING ON THE SHOULDER OF A DIVIDED ROADWAY OR FREEWAY



DURATION: LONG-TERM STATIONARY, INTERMEDIATE-TERM STATIONARY, SHORT-TERM STATIONARY

MDOT Michigan Department of Transportation
MAINTENANCE DIVISION

TRAFFIC CONTROL PLAN FOR WORKING ON THE SHOULDER

File: md02.dgn		MD-02	PAGE 12
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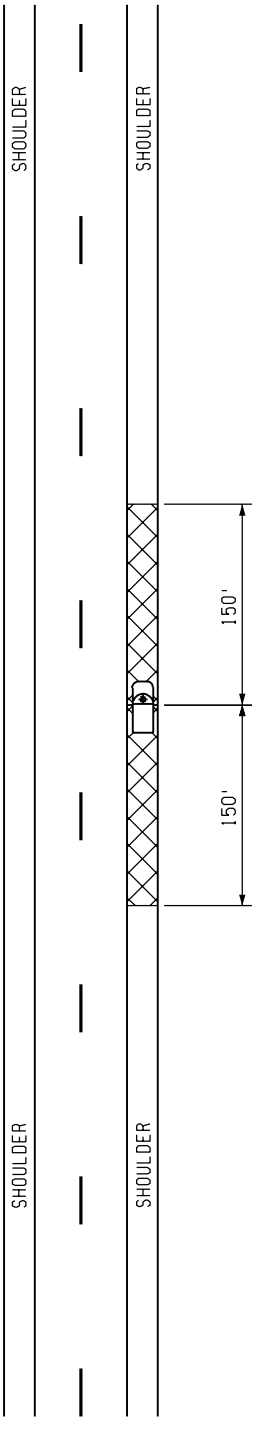

KEY

VEHICLE FROM WHICH WORK IS BEING PERFORMED

NOTES

AT A MINIMUM, TRAFFIC CONTROL SHALL CONSIST OF AN APPROPRIATELY SAFETY COLORED VEHICLE (OR A VEHICLE WITH CONSPICUITY TAPE ON BOTH SIDES AND THE REAR) WITH A ROTATING BEACON. NO SIGNS OR CHANNELIZING DEVICES ARE REQUIRED.

THE FOLLOWING FACTORS SHOULD BE CONSIDERED IN DETERMINING THE NEED FOR ADDITIONAL ADVANCE WARNING:

1. TRAFFIC VOLUME
2. POSTED AND OPERATING SPEED LIMITS
3. HORIZONTAL AND VERTICAL ALIGNMENTS
4. URBAN OR RURAL SITE

AVAILABLE DEVICES, LISTED IN ORDER OF INCREASING EFFECTIVENESS ARE:

MINIMUM - APPROPRIATELY SAFETY COLORED VEHICLE (OR A VEHICLE WITH CONSPICUITY TAPE ON BOTH SIDES AND THE REAR) WITH A ROTATING BEACON.

RECOMMENDATIONS 1-4 ARE ADDITIONS MOUNTED TO OR PULLED BEHIND THE APPROPRIATELY SAFETY COLORED VEHICLE (OR A VEHICLE WITH CONSPICUITY TAPE ON BOTH SIDES AND THE REAR) FROM WHICH THE WORK IS PERFORMED.

1. SINGLE STROBE VISIBLE 360° AT ALL TIMES
2. MULTIPLE STROBES VISIBLE 360° AT ALL TIMES
3. LIGHT BAR (OR TYPE A OR B ARROW BARS IN BAR MODE) VISIBLE TO TRAFFIC APPROACHING FROM BEHIND THE WORK VEHICLE
4. ARROW BARS, TYPE B OR C, VISIBLE TO TRAFFIC APPROACHING FROM BEHIND THE WORK VEHICLE
5. A SEPARATE VEHICLE TOWING A TYPE C ARROW BAR POSITIONED AN APPROPRIATE DISTANCE TO THE REAR OF THE WORK VEHICLE. THE WORK VEHICLE MUST STILL CONFORM TO AT LEAST THE MINIMUM ABOVE
6. DETAIL MD29 PAGE 18 OF THE GUIDELINES

DURATION: MOBILE

MDOT Michigan Department of Transportation
MAINTENANCE DIVISION

TRAFFIC CONTROL PLAN FOR MOBILE OPERATIONS WHERE A VEHICLE REMAINS ON THE SHOULDER WITH MINOR NON-VEHICULAR ENCROACHMENT IN THE TRAVELED WAY

File: md02.dgn		MD-04	PAGE 13
Drawn by:	Revision Date: 06-08-2004		

TOC

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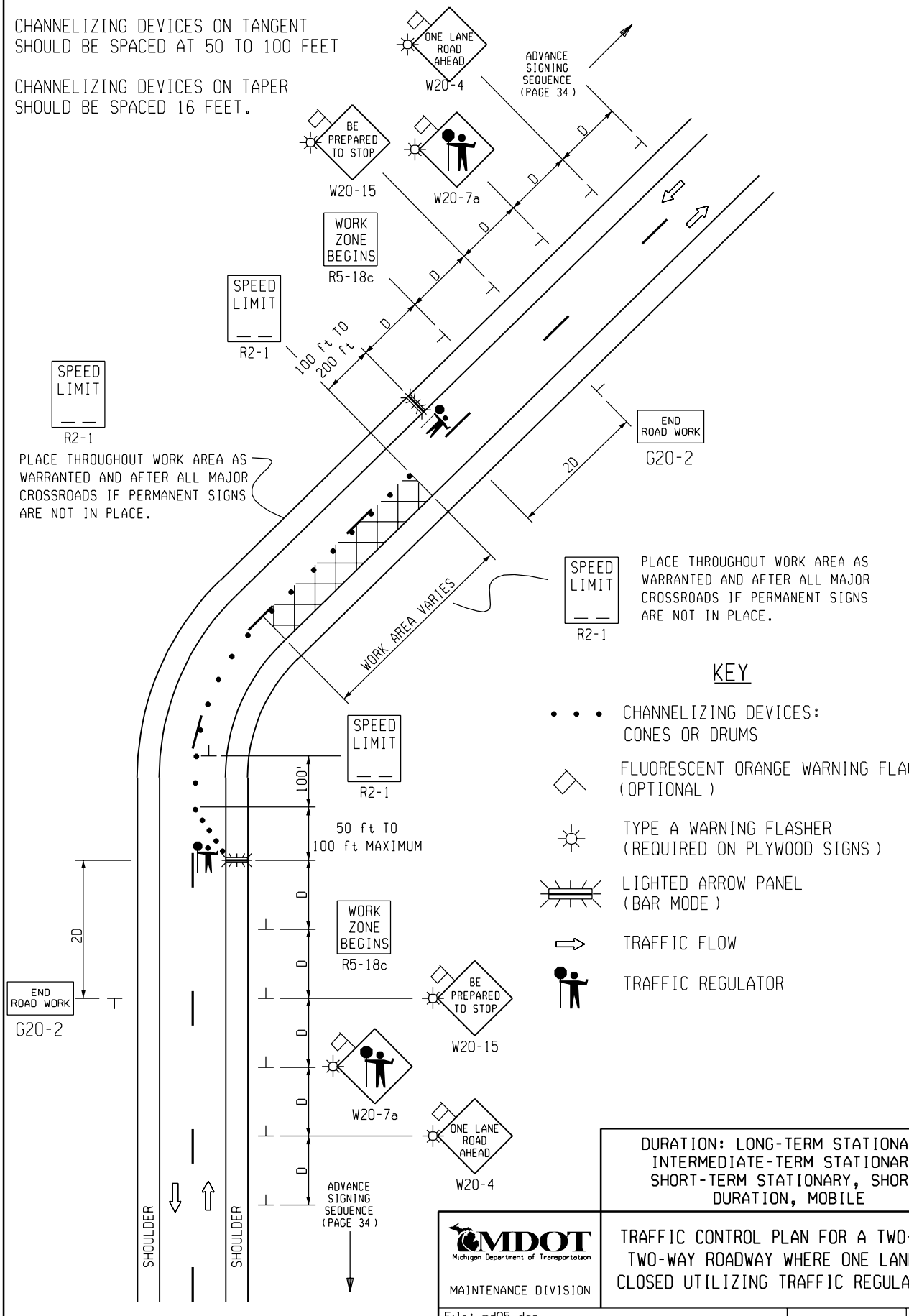
NOTES:

CHANNELIZING DEVICES ON TANGENT SHOULD BE SPACED AT 50 TO 100 FEET

CHANNELIZING DEVICES ON TAPER SHOULD BE SPACED 16 FEET.



KEY

- CHANNELIZING DEVICES: CONES OR DRUMS
- FLUORESCENT ORANGE WARNING FLAG (OPTIONAL)
- TYPE A WARNING FLASHER (REQUIRED ON PLYWOOD SIGNS)
- LIGHTED ARROW PANEL (BAR MODE)
- TRAFFIC FLOW
- TRAFFIC REGULATOR

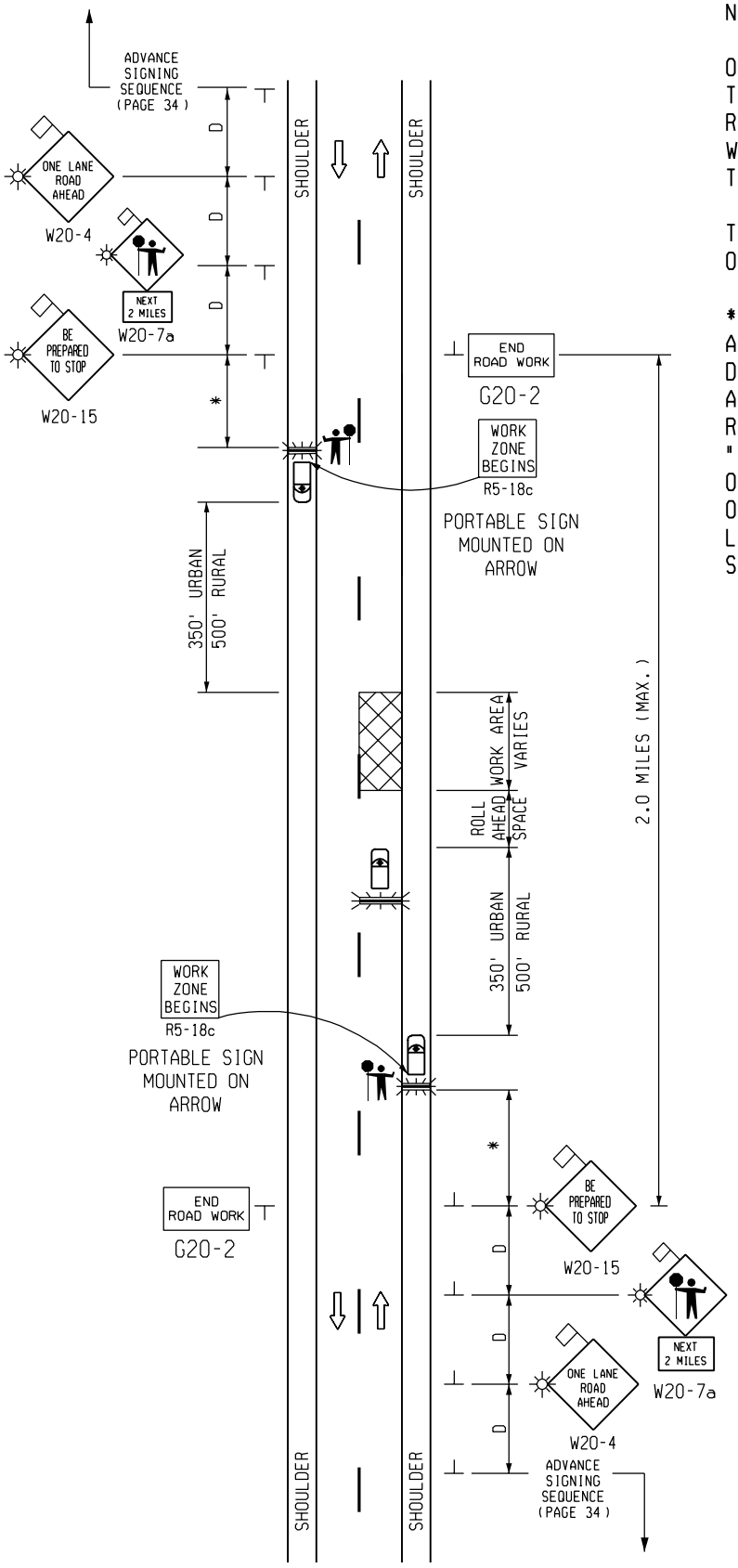
DURATION: LONG-TERM STATIONARY, INTERMEDIATE-TERM STATIONARY, SHORT-TERM STATIONARY, SHORT DURATION, MOBILE

MDOT Michigan Department of Transportation

MAINTENANCE DIVISION

TRAFFIC CONTROL PLAN FOR A TWO-LANE TWO-WAY ROADWAY WHERE ONE LANE IS CLOSED UTILIZING TRAFFIC REGULATORS

File: md05.dgn		MD-05	PAGE 14
Drawn by:	Revision Date: 06-08-2004		



NOTES:

ON THE SIDE OPPOSITE THE WORK AREA AS THE DISTANCE BETWEEN THE TRAFFIC REGULATOR AND W20-7a SIGNS DECREASES, W20-7a SIGNS CLOSER THAN "D" TO THE TRAFFIC REGULATOR SHALL BE PICKED UP.

THE "WORK ZONE BEGINS" SIGN IS PLACED ON THE FIRST ARROW IN EACH DIRECTION.

* IF THE DISTANCE EXCEEDS ½ MILE AN ADDITIONAL W20-7A SIGN (WITHOUT THE DISTANCE AHEAD PLACARD) SHALL BE ADDED TO THE SEQUENCE. THE TRAFFIC REGULATOR SHALL STAY A MINIMUM OF A "D" DISTANCE BEYOND THE LAST W20-7a OR W20-15 SIGN IN THE SEQUENCE. AS THE OPERATION MOVES ½ MILE BEYOND THE LAST W20-7a SIGN ANOTHER W20-7a SIGN SHALL BE ADDED TO THE SEQUENCE.

KEY

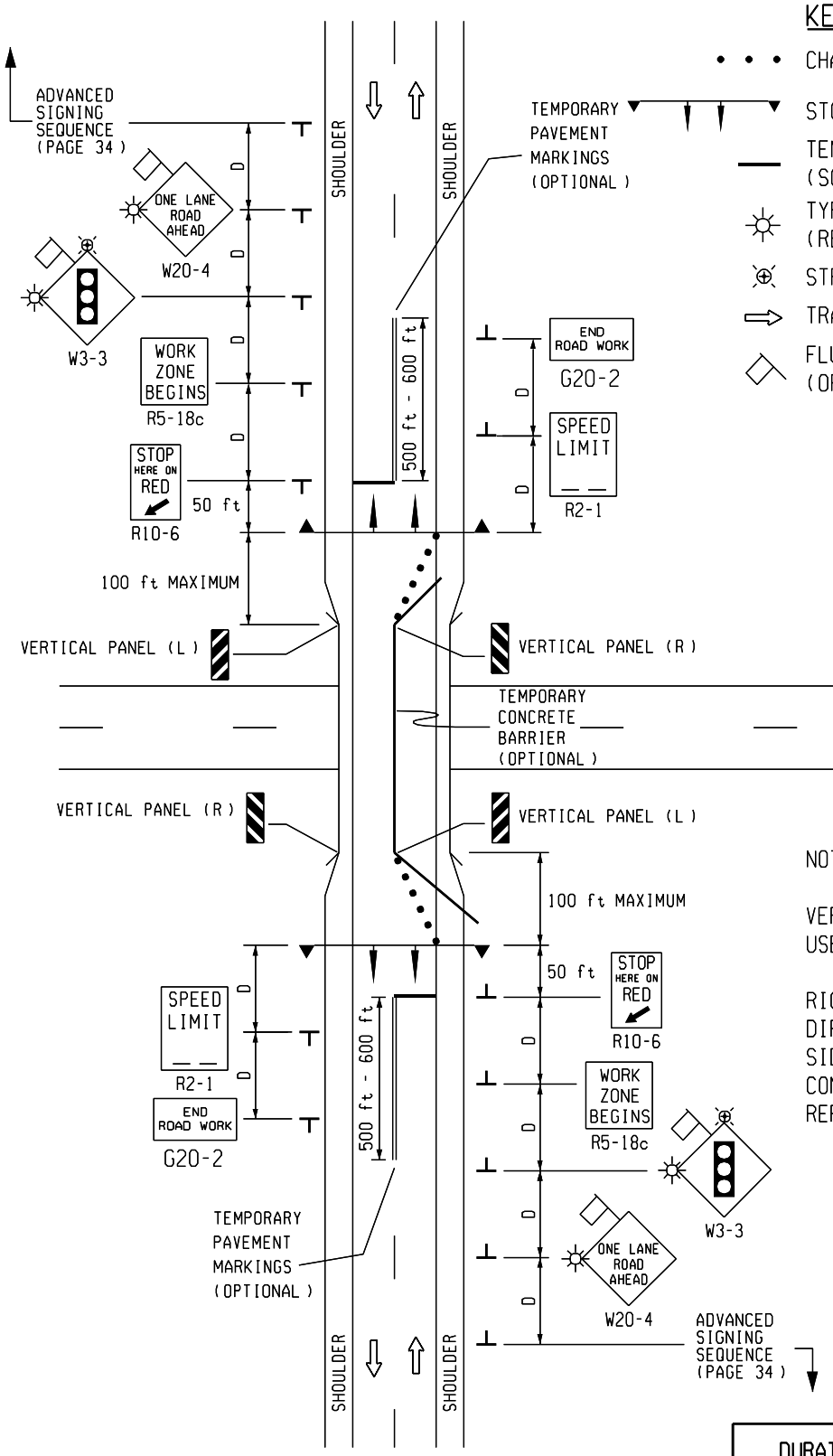
- FLUORESCENT ORANGE WARNING FLAG (OPTIONAL)
- TYPE A WARNING FLASHER (REQUIRED ON PLYWOOD SIGNS)
- LIGHTED ARROW PANEL (BAR MODE)
- VEHICLE
- TRAFFIC FLOW
- TRAFFIC REGULATOR

DURATION: SHORT DURATION, MOBILE

MDOT Michigan Department of Transportation
MAINTENANCE DIVISION

TRAFFIC CONTROL PLAN FOR A MOVING CLOSURE OF ONE LANE ON A TWO LANE ROAD

File: md12.dgn		MD-12	PAGE 15
Drawn by:	Revision Date: 06-08-2004		



KEY

- CHANNELIZING DEVICES
- STOP AND GO SIGNALS
- TEMPORARY PAVEMENT MARKING (SOLID 24 " STOP BAR)
- TYPE A WARNING FLASHER (REQUIRED ON PLYWOOD SIGNS)
- STROBE LIGHT (OPTIONAL)
- TRAFFIC FLOW
- FLUORESCENT ORANGE WARNING FLAG (OPTIONAL)

NOTES:

VERTICAL PANELS SHALL BE USED WITH CONCRETE BARRIERS

RIGHT SIDE SIGNING IN EACH DIRECTION IS REQUIRED, LEFT SIDE SIGNING IS OPTIONAL. CONSULT REGION/TSC TRAFFIC REPRESENTATIVE

DURATION: LONG-TERM STATIONARY, INTERMEDIATE-TERM STATIONARY, SHORT-TERM STATIONARY

MDOT Michigan Department of Transportation
MAINTENANCE DIVISION

TRAFFIC CONTROL PLAN FOR A TEMPORARY TRAFFIC SIGNAL, TWO-LANE TWO-WAY ROADWAY

File: md06.dgn		MD-06	PAGE 16
Drawn by:	Revision Date: 06-08-2004		

TOC

Typ.

KEY

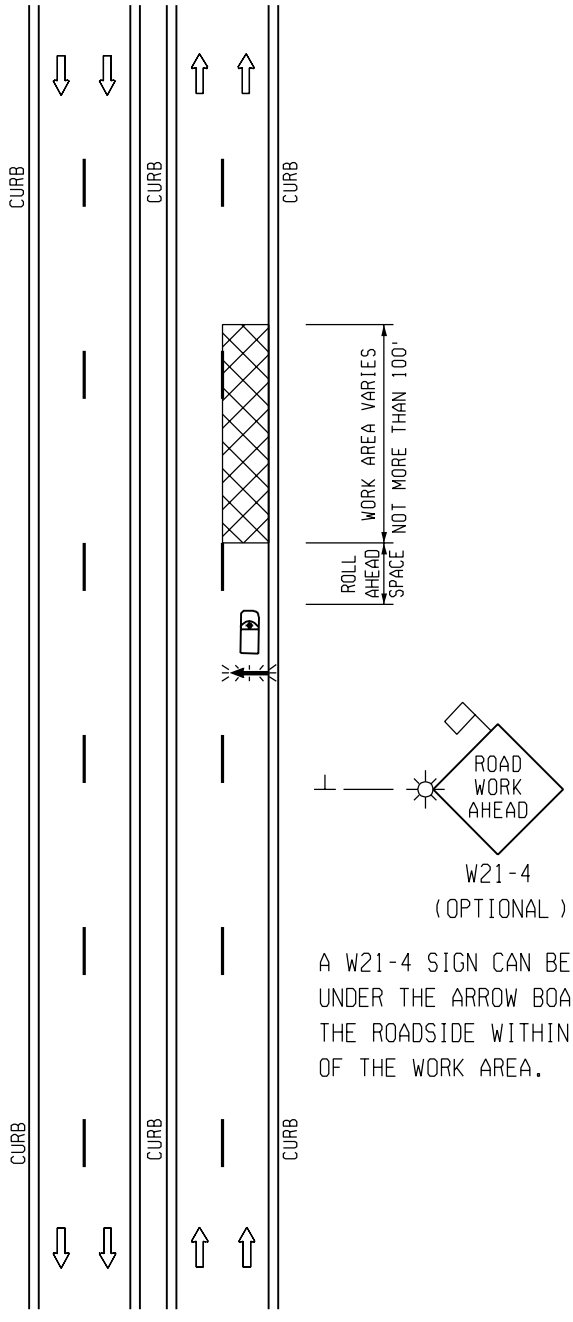
LIGHTED ARROW PANEL

FLUORESCENT ORANGE WARNING FLAG (OPTIONAL)

TYPE A WARNING FLASHER (REQUIRED ON PLYWOOD SIGNS)

SHADOW VEHICLE WITH FLASHING OR ROTATING LIGHTS AND OPTIONAL TRUCK MOUNTED ATTENUATOR

TRAFFIC FLOW



W21-4
(OPTIONAL)

A W21-4 SIGN CAN BE MOUNTED UNDER THE ARROW BOARD OR ON THE ROADSIDE WITHIN ONE MILE OF THE WORK AREA.

NOTES:

"ROAD WORK AHEAD" SIGN IF USED SHOULD BE WITHIN ONE MILE OF WORK AREA.

CLOSURE - ONE LANE OF MULTI-LANE ROAD WITH POSTED SPEEDS OF 45 MPH OR LESS.

THIS DETAIL IS ONLY ALLOWED IN AREAS WITHOUT SHOULDERS.

USED FOR PATROLING MINOR PATCHING AND OTHER ACTIVITIES IN AREAS WITH CURBS.

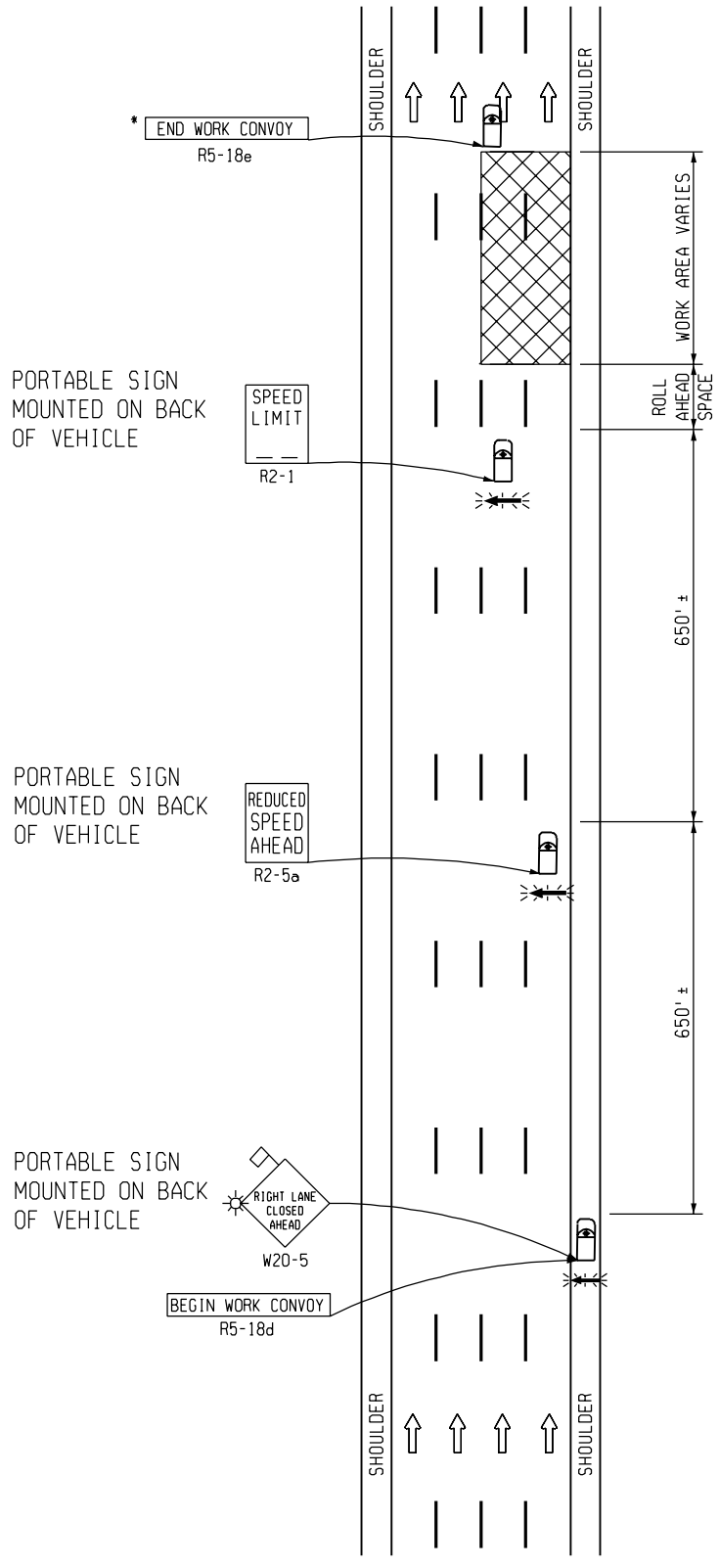
DURATION: SHORT DURATION, MOBILE

MDOT Michigan Department of Transportation

MAINTENANCE DIVISION

TRAFFIC CONTROL PLAN FOR CLOSING ONE LANE OF A MULTI-LANE ROADWAY WITH CURBS

File: md11.dgn		MD-11	PAGE 17
Drawn by:	Revision Date: 06-08-2004		



KEY

- LIGHTED ARROW PANEL
- FLUORESCENT ORANGE WARNING FLAG (OPTIONAL)
- TYPE A WARNING FLASHER (REQUIRED ON PLYWOOD SIGNS)
- VEHICLE AND OPTIONAL TRUCK MOUNTED ATTENUATOR
- TRAFFIC FLOW

NOTE

CLOSURE - ONE OR TWO LANES

10 MPH REDUCTION IN POSTED SPEED

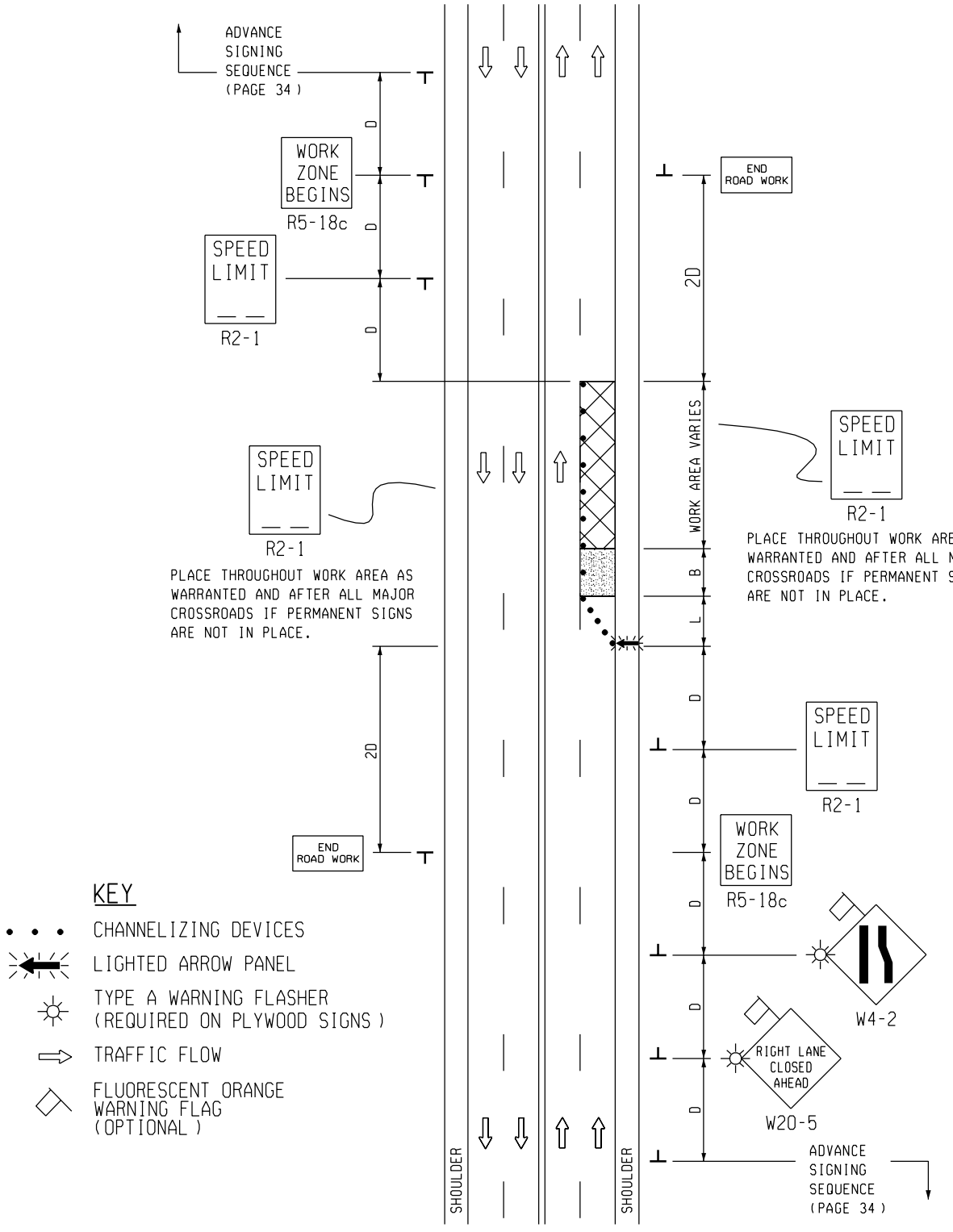
* PLACE END WORK CONVOY SIGN ON LAST VEHICLE IN WORK AREA

DURATION: SHORT DURATION, MOBILE

MDOT Michigan Department of Transportation
MAINTENANCE DIVISION

TRAFFIC CONTROL PLAN FOR URBAN FREEWAY OPERATION

File: md29.dgn		MD-29	PAGE 18
Drawn by:	Revision Date: 06-08-2004		



NOTES:

CHANNELIZING DEVICES ON TANGENT SHOULD BE SPACED AT 50 TO 100 FEET

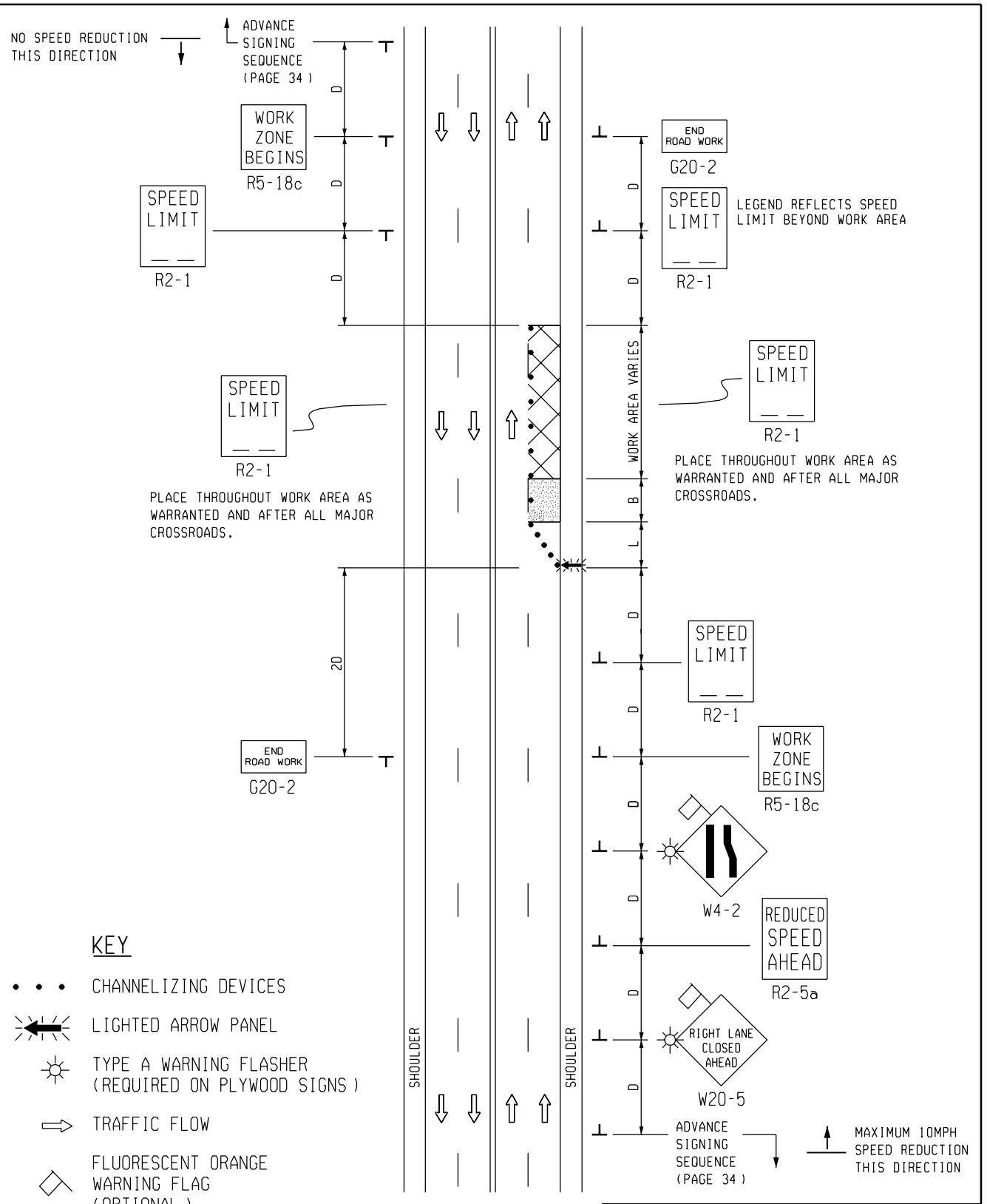
DURATION: LONG-TERM STATIONARY, INTERMEDIATE-TERM STATIONARY, SHORT-TERM STATIONARY

MDOT Michigan Department of Transportation
MAINTENANCE DIVISION

TRAFFIC CONTROL PLAN FOR A LANE CLOSURE ON AN UNDIVIDED MULTI-LANE ROADWAY, WITH NO REDUCTION IN POSTED SPEED

File: md08.dgn
Drawn by:
Revision Date: 06-08-2004

MD-08



KEY

- • • • CHANNELIZING DEVICES
- LIGHTED ARROW PANEL
- TYPE A WARNING FLASHER (REQUIRED ON PLYWOOD SIGNS)
- TRAFFIC FLOW
- FLUORESCENT ORANGE WARNING FLAG (OPTIONAL)

NOTES:

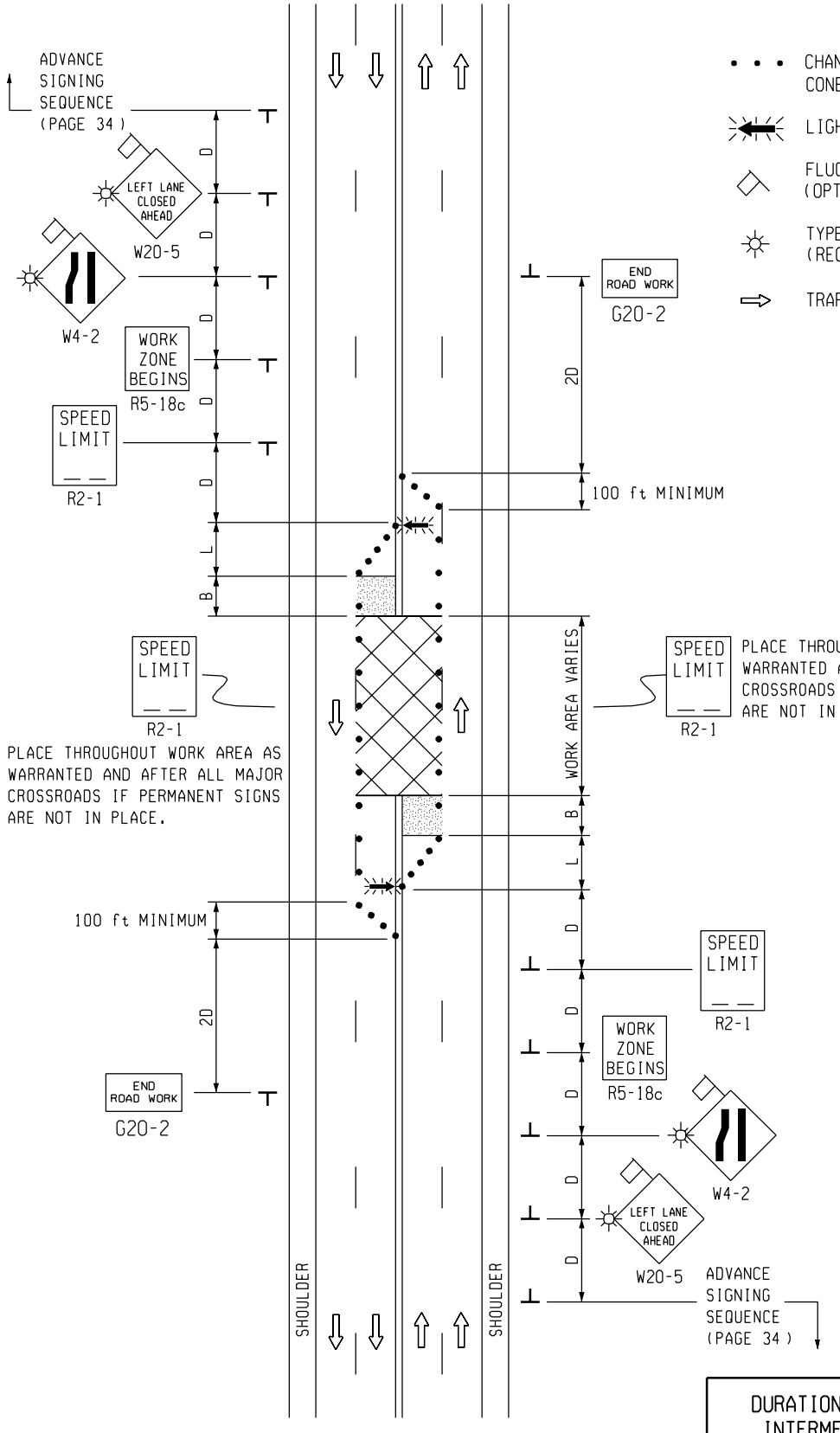
CHANNELIZING DEVICES ON TANGENT SHOULD BE SPACED AT 50 TO 100 FEET.

DURATION: LONG-TERM STATIONARY, INTERMEDIATE-TERM STATIONARY, SHORT-TERM STATIONARY

MDOT Michigan Department of Transportation
MAINTENANCE DIVISION

TRAFFIC CONTROL PLAN FOR A LANE CLOSURE ON AN UNDIVIDED MULTI-LANE ROADWAY, WITH A 10 MPH REDUCTION IN POSTED SPEED

File: md08.dgn		MD-08a	PAGE 20
Drawn by:	Revision Date: 06-08-2004		



NOTES:

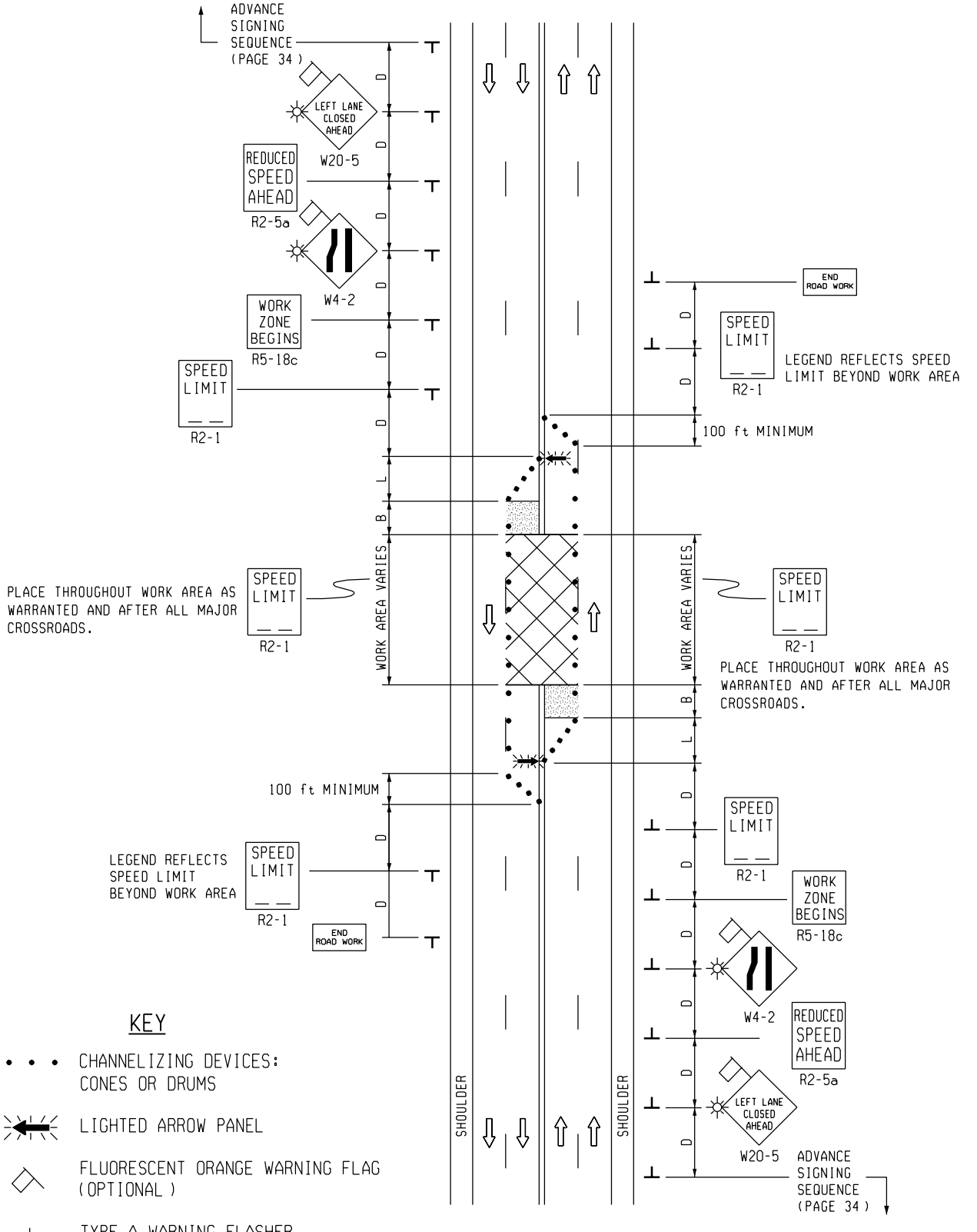
CHANNELIZING DEVICES ON TANGENT SHOULD BE SPACED AT 50 TO 100 FEET

DURATION: LONG-TERM STATIONARY, INTERMEDIATE-TERM STATIONARY, SHORT-TERM STATIONARY

MDOT Michigan Department of Transportation
MAINTENANCE DIVISION

TRAFFIC CONTROL PLAN FOR CLOSING THE CENTER TWO LANES OF A FOUR-LANE UNDIVIDED ROADWAY, NO REDUCTION IN POSTED SPEED

File: md10.dgn		MD-10	PAGE 21
Drawn by:	Revision Date: 06-08-2004		



KEY

- • • • CHANNELIZING DEVICES: CONES OR DRUMS
- LIGHTED ARROW PANEL
- FLUORESCENT ORANGE WARNING FLAG (OPTIONAL)
- TYPE A WARNING FLASHER (REQUIRED ON PLYWOOD SIGNS)
- TRAFFIC FLOW

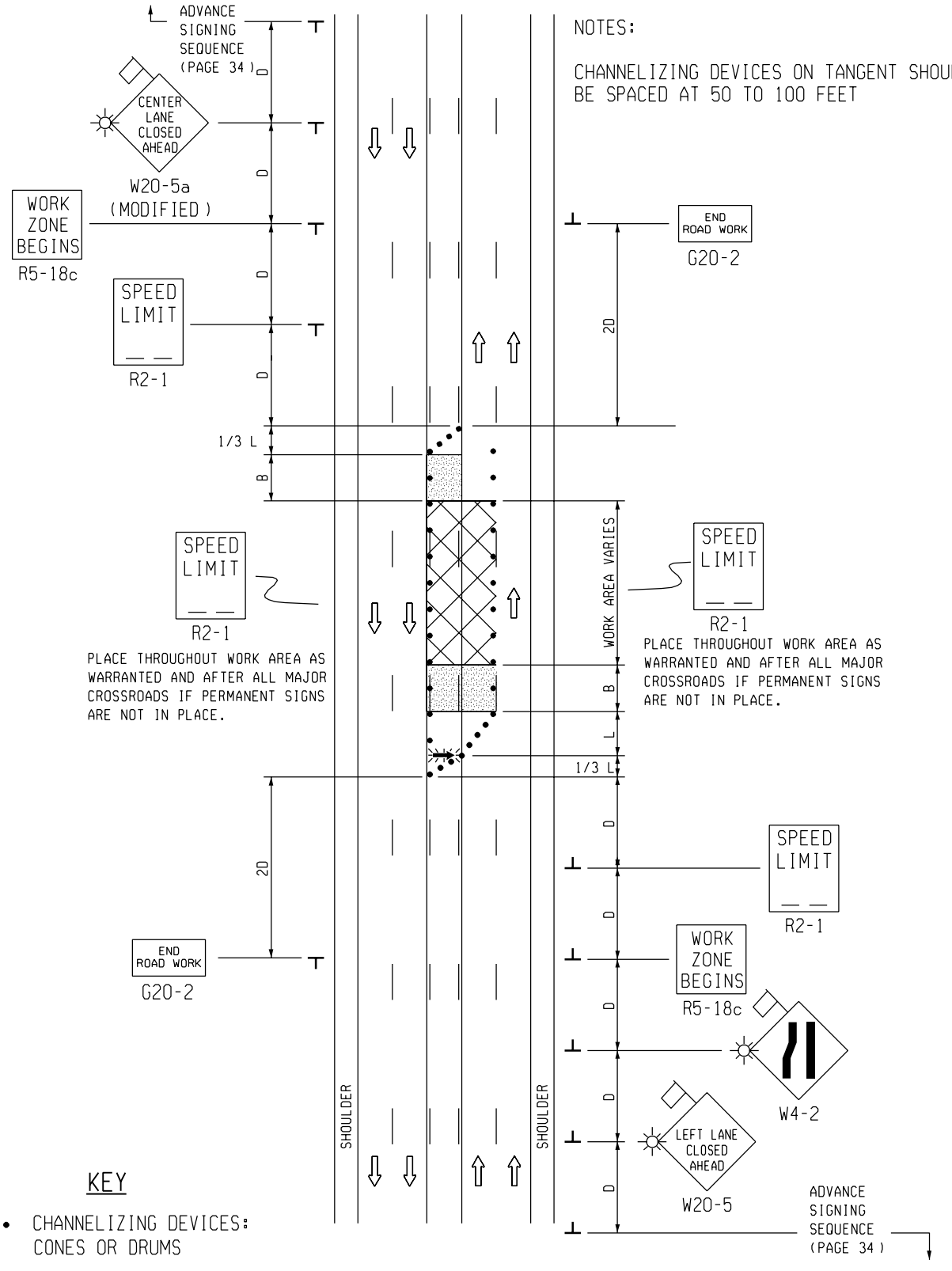
DURATION: LONG-TERM STATIONARY, INTERMEDIATE-TERM STATIONARY, SHORT-TERM STATIONARY

MDOT Michigan Department of Transportation
MAINTENANCE DIVISION

TRAFFIC CONTROL PLAN FOR CLOSING THE CENTER TWO LANES OF A FOUR-LANE UNDIVIDED ROADWAY, WITH A 10 MPH REDUCTION IN POSTED SPEED

File: md10a.dgn
Drawn by:
Revision Date: 06-08-2004

MD-10a



NOTES:

CHANNELIZING DEVICES ON TANGENT SHOULD BE SPACED AT 50 TO 100 FEET

KEY

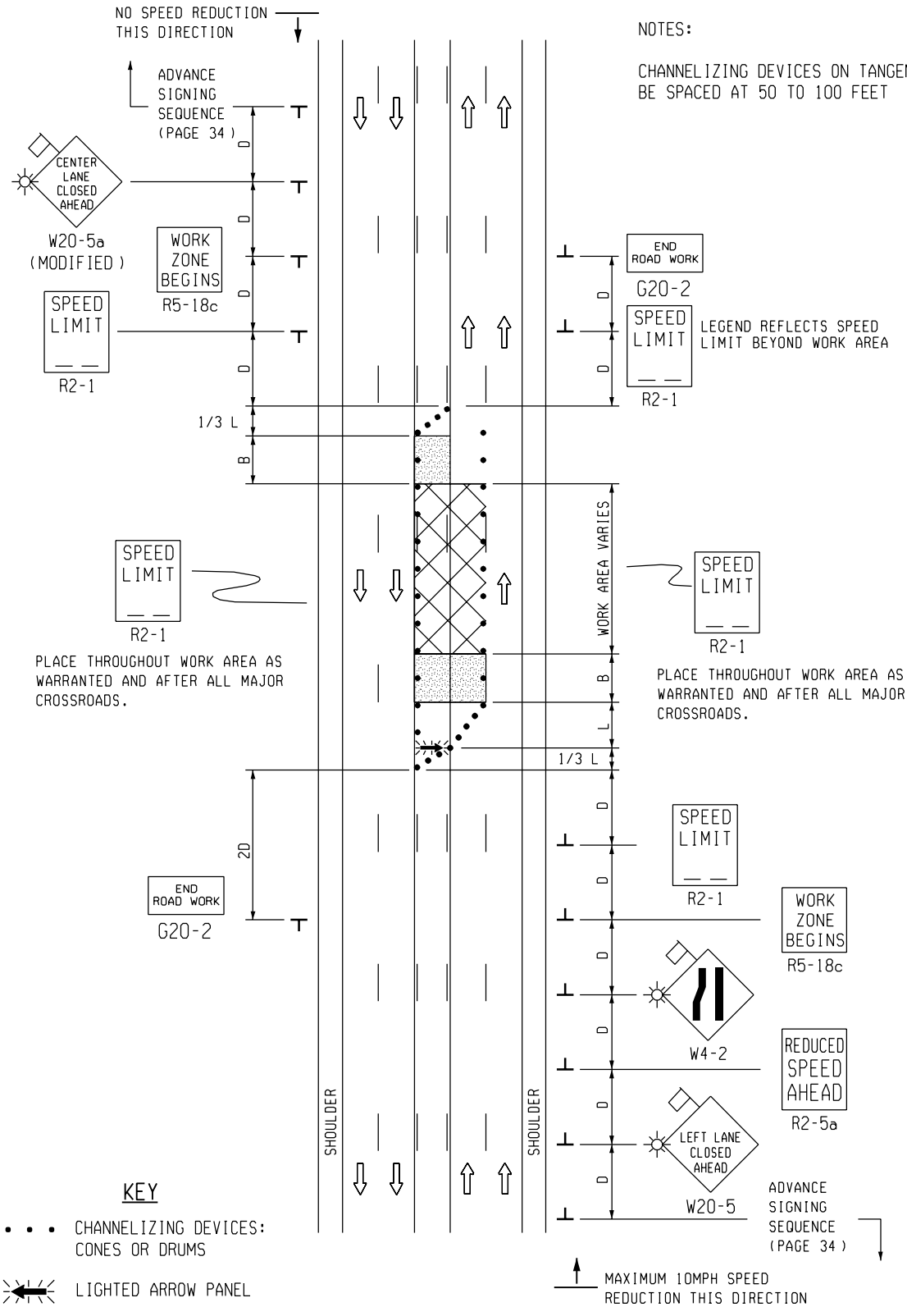
- • • • CHANNELIZING DEVICES: CONES OR DRUMS
- LIGHTED ARROW PANEL
- TYPE A WARNING FLASHER (REQUIRED ON PLYWOOD SIGNS)
- FLUORESCENT ORANGE WARNING FLAG (OPTIONAL)
- TRAFFIC FLOW

DURATION: LONG-TERM STATIONARY, INTERMEDIATE-TERM STATIONARY, SHORT-TERM STATIONARY

MDOT Michigan Department of Transportation
MAINTENANCE DIVISION

TRAFFIC CONTROL PLAN FOR CLOSING THE CENTER LANES ON A MULTI-LANE UNDIVIDED ROADWAY, WITH NO REDUCTION IN POSTED SPEED

File: md09a.dgn		MD-09a	PAGE 23
Drawn by:	Revision Date: 06-08-2004		

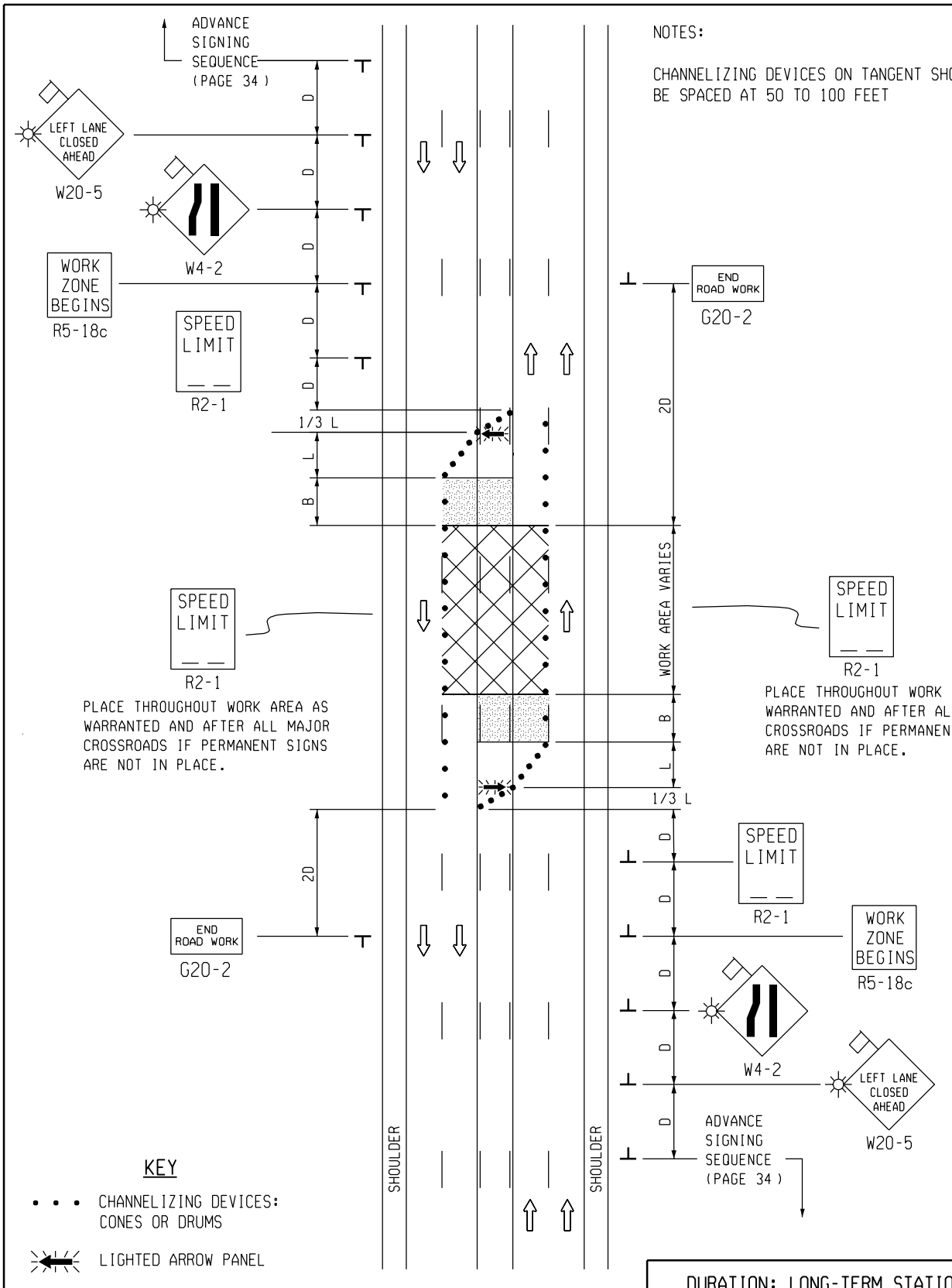


DURATION: LONG-TERM STATIONARY, INTERMEDIATE-TERM STATIONARY, SHORT-TERM STATIONARY

MDOT Michigan Department of Transportation
MAINTENANCE DIVISION

TRAFFIC CONTROL PLAN FOR CLOSING THE CENTER LANES ON A MULTI-LANE UNDIVIDED ROADWAY, WITH A 10 MPH REDUCTION IN POSTED SPEED

File: md09b.dgn		MD-09b	PAGE 24
Drawn by:	Revision Date: 06-08-2004		



NOTES:

CHANNELIZING DEVICES ON TANGENT SHOULD BE SPACED AT 50 TO 100 FEET

PLACE THROUGHOUT WORK AREA AS WARRANTED AND AFTER ALL MAJOR CROSSROADS IF PERMANENT SIGNS ARE NOT IN PLACE.

PLACE THROUGHOUT WORK AREA AS WARRANTED AND AFTER ALL MAJOR CROSSROADS IF PERMANENT SIGNS ARE NOT IN PLACE.

KEY

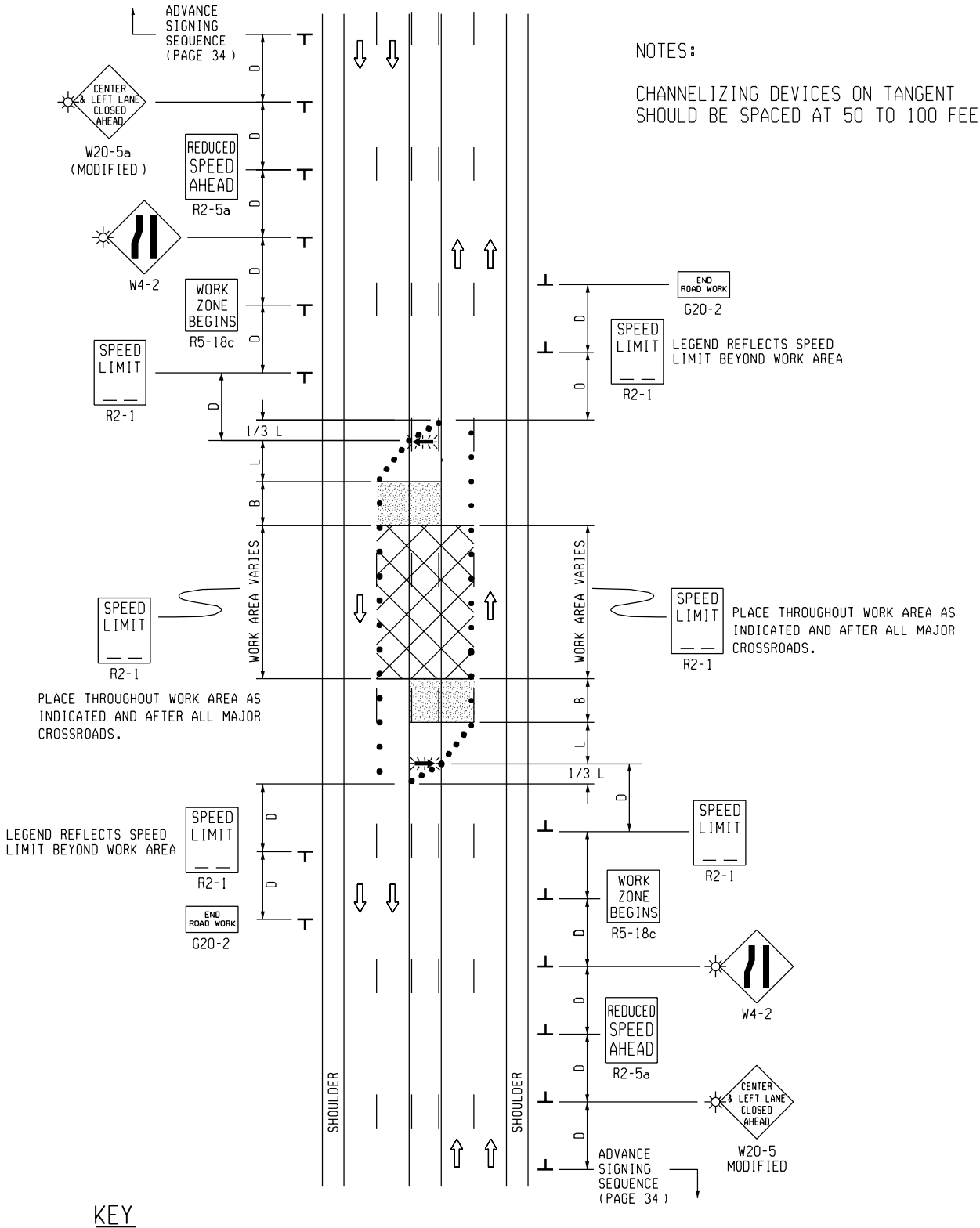
- CHANNELIZING DEVICES: CONES OR DRUMS
- LIGHTED ARROW PANEL
- FLUORESCENT ORANGE WARNING FLAG (OPTIONAL)
- TYPE A WARNING FLASHER (REQUIRED ON PLYWOOD SIGNS)
- TRAFFIC FLOW

DURATION: LONG-TERM STATIONARY, INTERMEDIATE-TERM STATIONARY, SHORT-TERM STATIONARY

MDOT Michigan Department of Transportation
MAINTENANCE DIVISION

TRAFFIC CONTROL PLAN FOR CLOSING THE CENTER AND ADJACENT LANES OF A 5 LANE UNDIVIDED ROADWAY WITH NO REDUCTION IN POSTED SPEED

File: md09.dgn
Drawn by:
Revision Date: 06-08-2004



KEY

- • • • CHANNELIZING DEVICES
- LIGHTED ARROW PANEL
- TYPE A WARNING FLASHER (REQUIRED ON PLYWOOD SIGNS)
- TRAFFIC FLOW
- FLUORESCENT ORANGE WARNING FLAG (OPTIONAL)

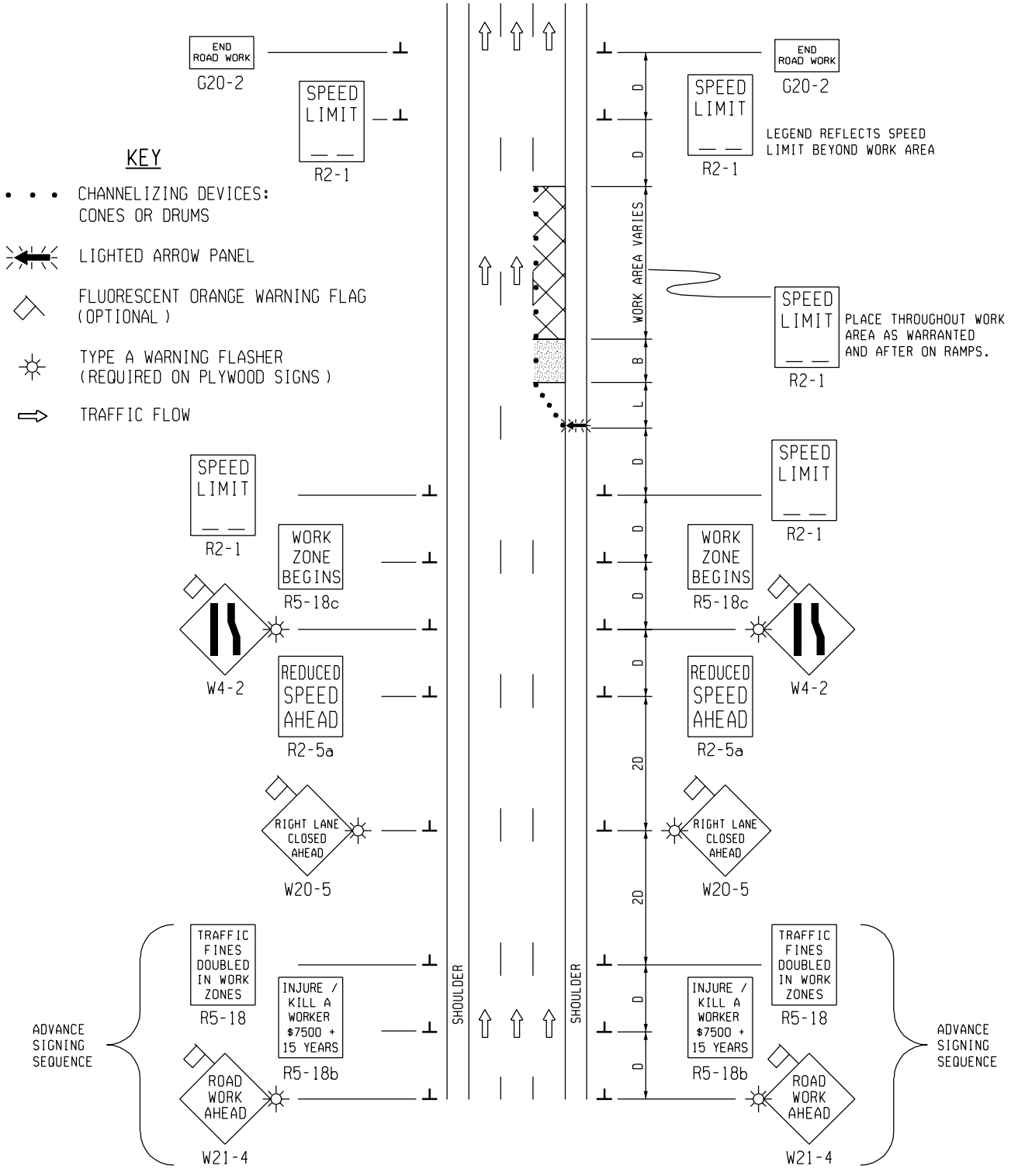
DURATION: LONG-TERM STATIONARY, INTERMEDIATE-TERM STATIONARY, SHORT-TERM STATIONARY

MDOT Michigan Department of Transportation
MAINTENANCE DIVISION

TRAFFIC CONTROL PLAN FOR CLOSING THE CENTER AND ADJACENT LANES OF A 5 LANE UNDIVIDED ROADWAY WITH 10 MPH REDUCTION IN POSTED SPEED

File: md24.dgn
Drawn by:
Revision Date: 06-08-2004

MD-24



NOTES:

CHANNELIZING DEVICES ON TANGENT SHOULD BE SPACED AT 50 to 100 FEET

EXISTING SPEED LIMIT SIGNS IN THE WORK AREA SHALL BE COVERED.

DURATION:
INTERMEDIATE-TERM STATIONARY,
SHORT-TERM STATIONARY

MDOT Michigan Department of Transportation
MAINTENANCE DIVISION

TRAFFIC CONTROL PLAN FOR A SINGLE LANE CLOSURE ON FREEWAY WITH 10 MPH REDUCTION IN POSTED SPEED

File: md21.dgn		MD-21	PAGE 27
Drawn by:	Revision Date: 06-08-2004		

TOC

Typ.

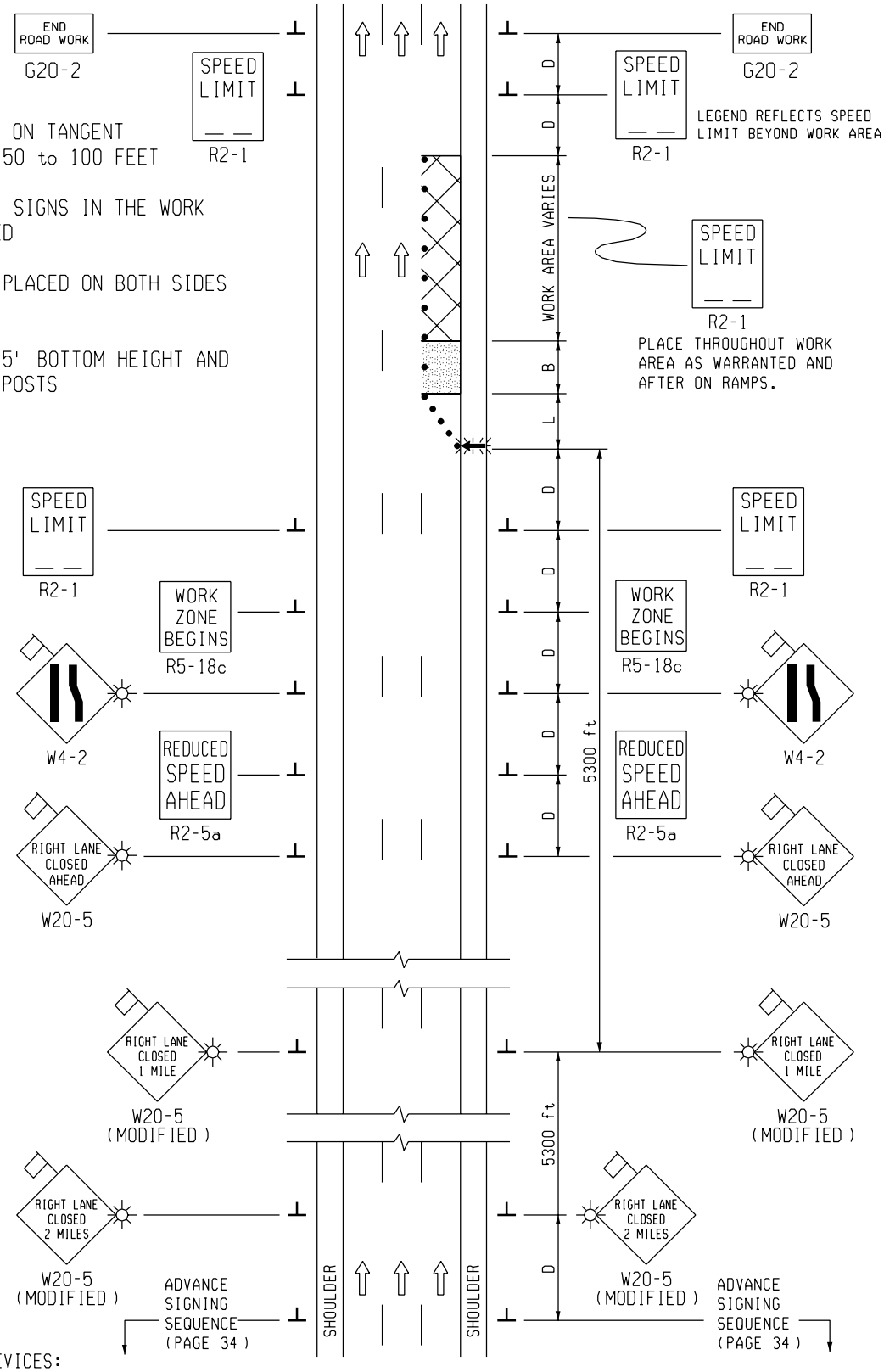
NOTES:

CHANNELIZING DEVICES ON TANGENT SHOULD BE SPACED AT 50 to 100 FEET

EXISTING SPEED LIMIT SIGNS IN THE WORK AREA SHALL BE COVERED

ALL SIGNS ARE TO BE PLACED ON BOTH SIDES OF THE ROADWAY

SIGNS SHOULD HAVE A 5' BOTTOM HEIGHT AND SHOULD BE ON DRIVEN POSTS



KEY

- CHANNELIZING DEVICES: CONES OR DRUMS
- LIGHTED ARROW PANEL
- FLUORESCENT ORANGE WARNING FLAG (OPTIONAL)
- TYPE A WARNING FLASHER (REQUIRED ON PLYWOOD SIGNS)
- TRAFFIC FLOW

DURATION: LONG-TERM STATIONARY

MDOT Michigan Department of Transportation

MAINTENANCE DIVISION

TRAFFIC CONTROL PLAN FOR A SINGLE LANE CLOSURE ON FREEWAY WITH A 10 MPH REDUCTION IN POSTED SPEED

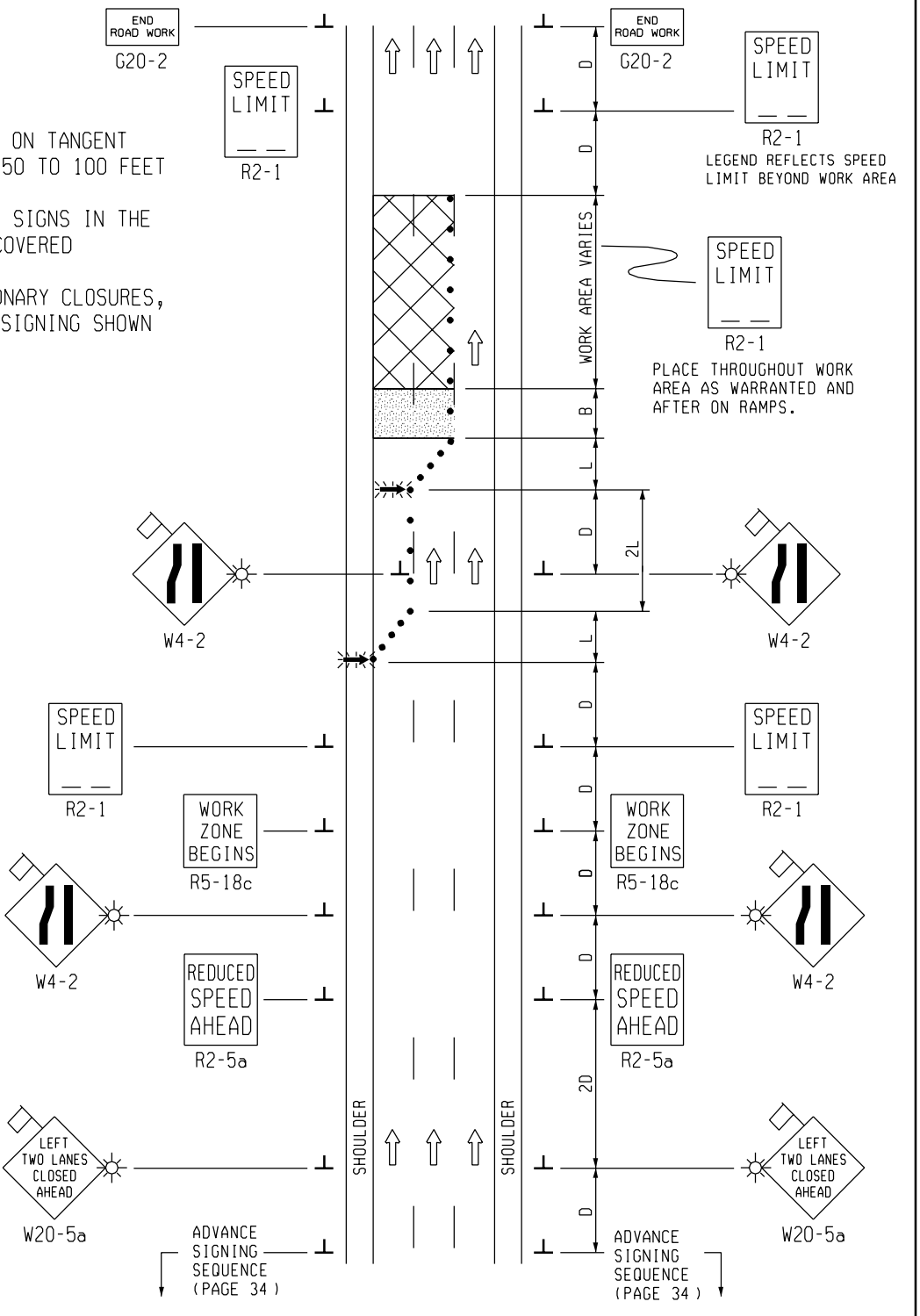
File: md21.dgn		MD-21a	PAGE 28
Drawn by:	Revision Date: 06-08-2004		

NOTES:

CHANNELIZING DEVICES ON TANGENT SHOULD BE SPACED AT 50 TO 100 FEET

EXISTING SPEED LIMIT SIGNS IN THE WORK AREA SHALL BE COVERED

FOR LONG-TERM STATIONARY CLOSURES, ADDITIONAL REQUIRED SIGNING SHOWN ON PAGE 28



KEY

- • • • CHANNELIZING DEVICES: CONES OR DRUMS
- LIGHTED ARROW PANEL
- FLUORESCENT ORANGE WARNING FLAG (OPTIONAL)
- TYPE A WARNING FLASHER (REQUIRED ON PLYWOOD SIGNS)
- TRAFFIC FLOW

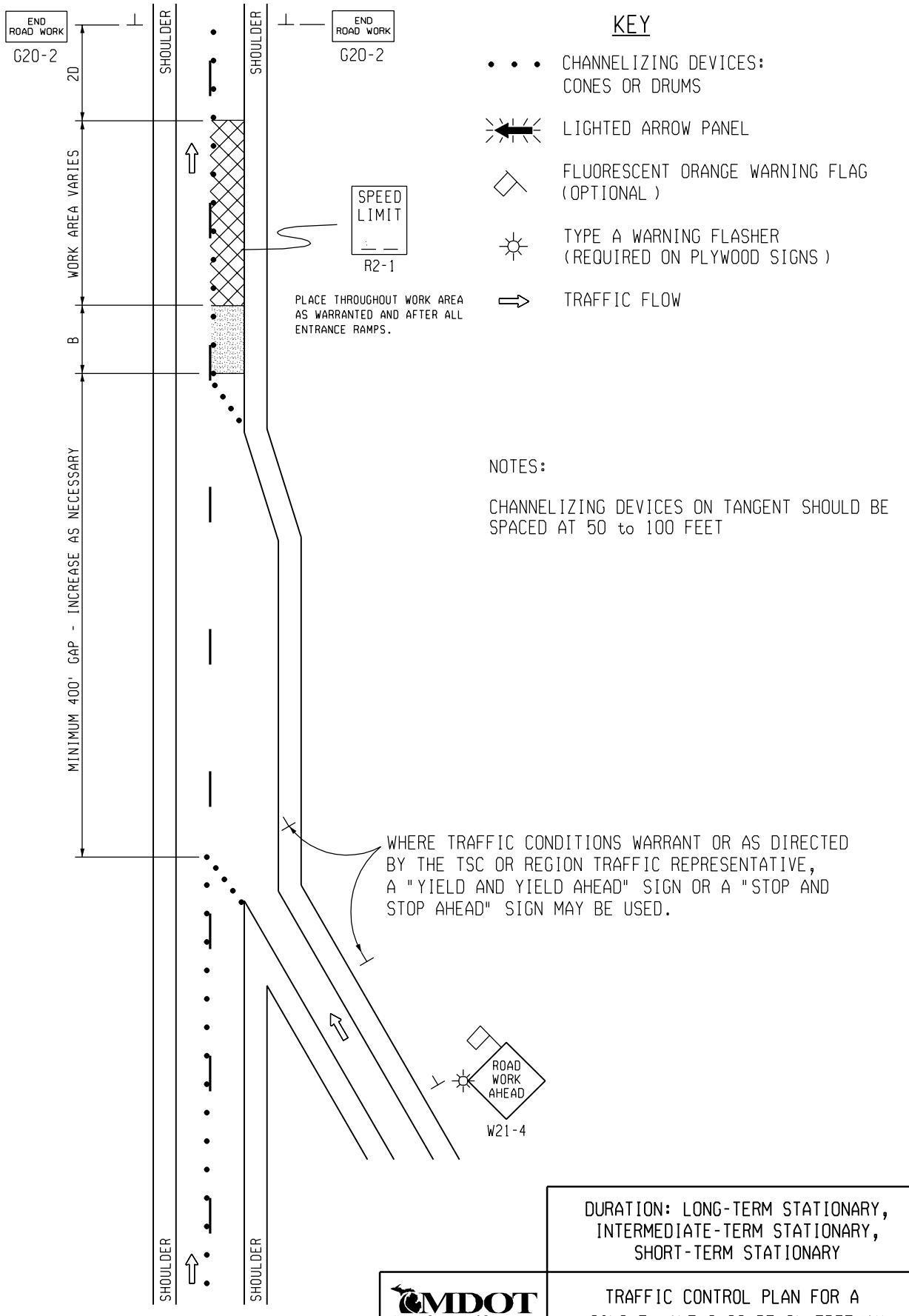
DURATION: SHORT-TERM STATIONARY

MDOT Michigan Department of Transportation
MAINTENANCE DIVISION

TRAFFIC CONTROL PLAN FOR A TWO LANE CLOSURE ON FREEWAY WITH A 10 MPH REDUCTION IN POSTED SPEED

File: md21.dgn
Drawn by:
Revision Date: 06-08-2004

MD-21b



ADVANCED SIGNING AND CHANNELIZING SHALL CONFORM TO THE TYPICAL FOR A SINGLE LANE CLOSURE

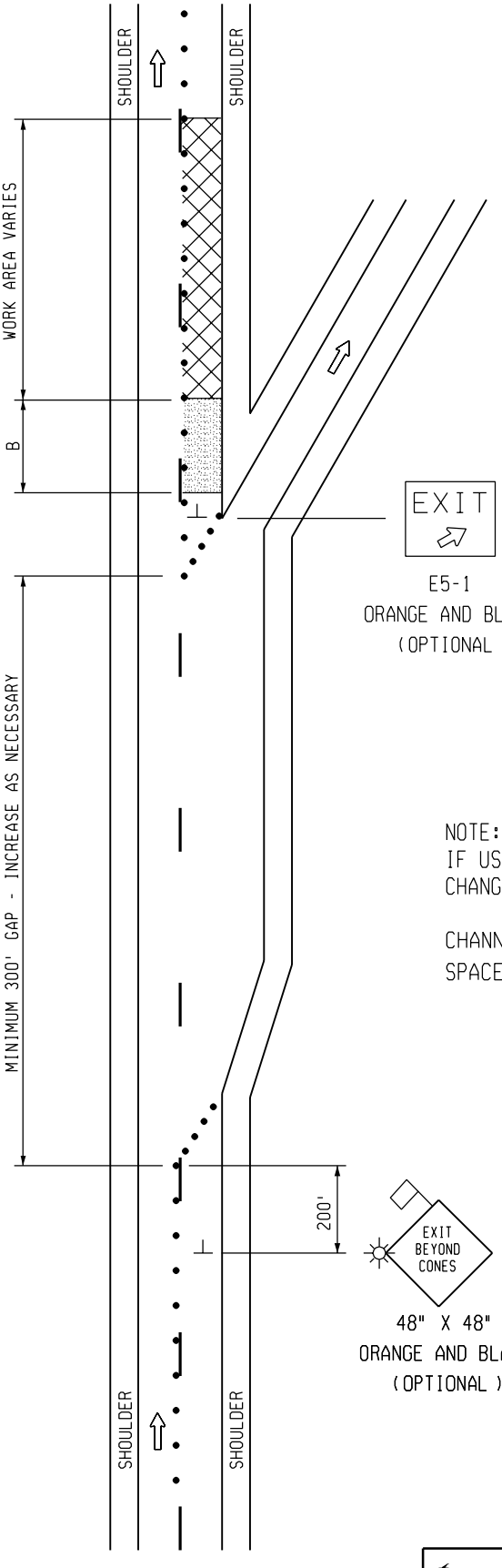
DURATION: LONG-TERM STATIONARY, INTERMEDIATE-TERM STATIONARY, SHORT-TERM STATIONARY

MDOT Michigan Department of Transportation
MAINTENANCE DIVISION

TRAFFIC CONTROL PLAN FOR A SINGLE LANE CLOSURE ON FREEWAY THROUGH ENTRANCE RAMP AREA

File: md22.dgn
Drawn by:
Revision Date: 06-08-2004

MD-22



KEY

- • • • CHANNELIZING DEVICES: CONES OR DRUMS
- FLUORESCENT ORANGE WARNING FLAG (OPTIONAL)
- TYPE A WARNING FLASHER (REQUIRED ON PLYWOOD SIGNS)
- TRAFFIC FLOW

EXIT

E5-1
ORANGE AND BLACK
(OPTIONAL)

EXIT BEYOND CONES

48" X 48"
ORANGE AND BLACK
(OPTIONAL)

NOTE:
IF USING CHANNELIZING DEVICE BESIDES CONES, CHANGE THE TEXT OF THE SIGN TO MATCH.

CHANNELIZING DEVICES ON TANGENT SHOULD BE SPACED AT 50 to 100 FEET

ADVANCE SIGNING AND CHANNELIZING SHALL CONFORM TO THE TYPICAL FOR A SINGLE LANE CLOSURE

DURATION: LONG-TERM STATIONARY, INTERMEDIATE-TERM STATIONARY, SHORT-TERM STATIONARY

MDOT Michigan Department of Transportation
MAINTENANCE DIVISION

TRAFFIC CONTROL PLAN FOR A SINGLE LANE CLOSURE ON FREEWAY THROUGH EXIT RAMP AREA

File: md23.dgn		MD-23	PAGE 31
Drawn by:	Revision Date: 06-08-2004		

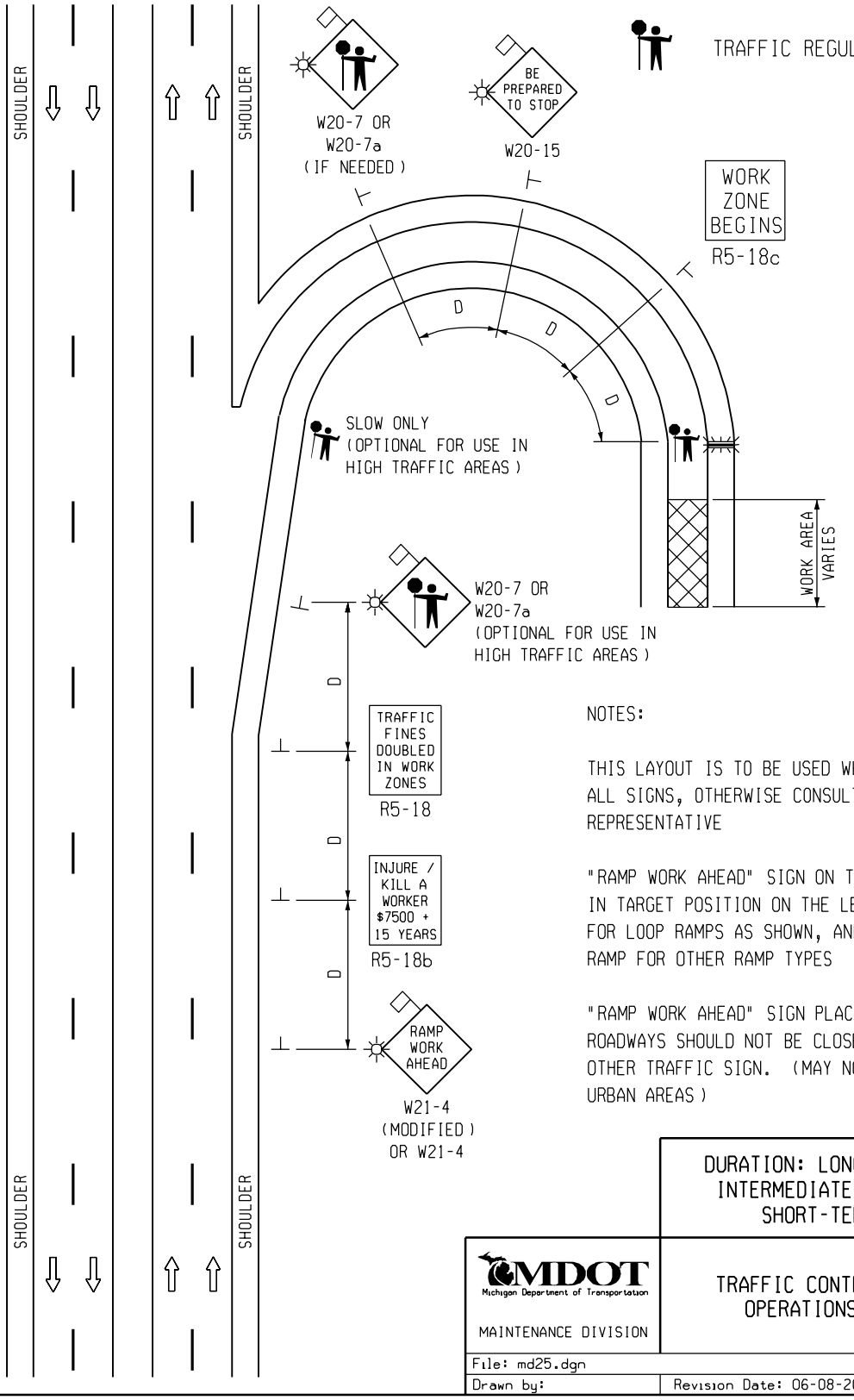
KEY

FLUORESCENT ORANGE WARNING FLAG (OPTIONAL)

TYPE A WARNING FLASHER (REQUIRED ON PLYWOOD SIGNS)

LIGHTED ARROW PANEL (BAR MODE)

TRAFFIC REGULATOR



NOTES:

THIS LAYOUT IS TO BE USED WHERE THERE IS ROOM FOR ALL SIGNS, OTHERWISE CONSULT TSC OR REGION TRAFFIC REPRESENTATIVE

"RAMP WORK AHEAD" SIGN ON THE RAMP MAY BE LOCATED IN TARGET POSITION ON THE LEFT SIDE OF THE RAMP FOR LOOP RAMPS AS SHOWN, AND ON THE RIGHT SIDE OF RAMP FOR OTHER RAMP TYPES

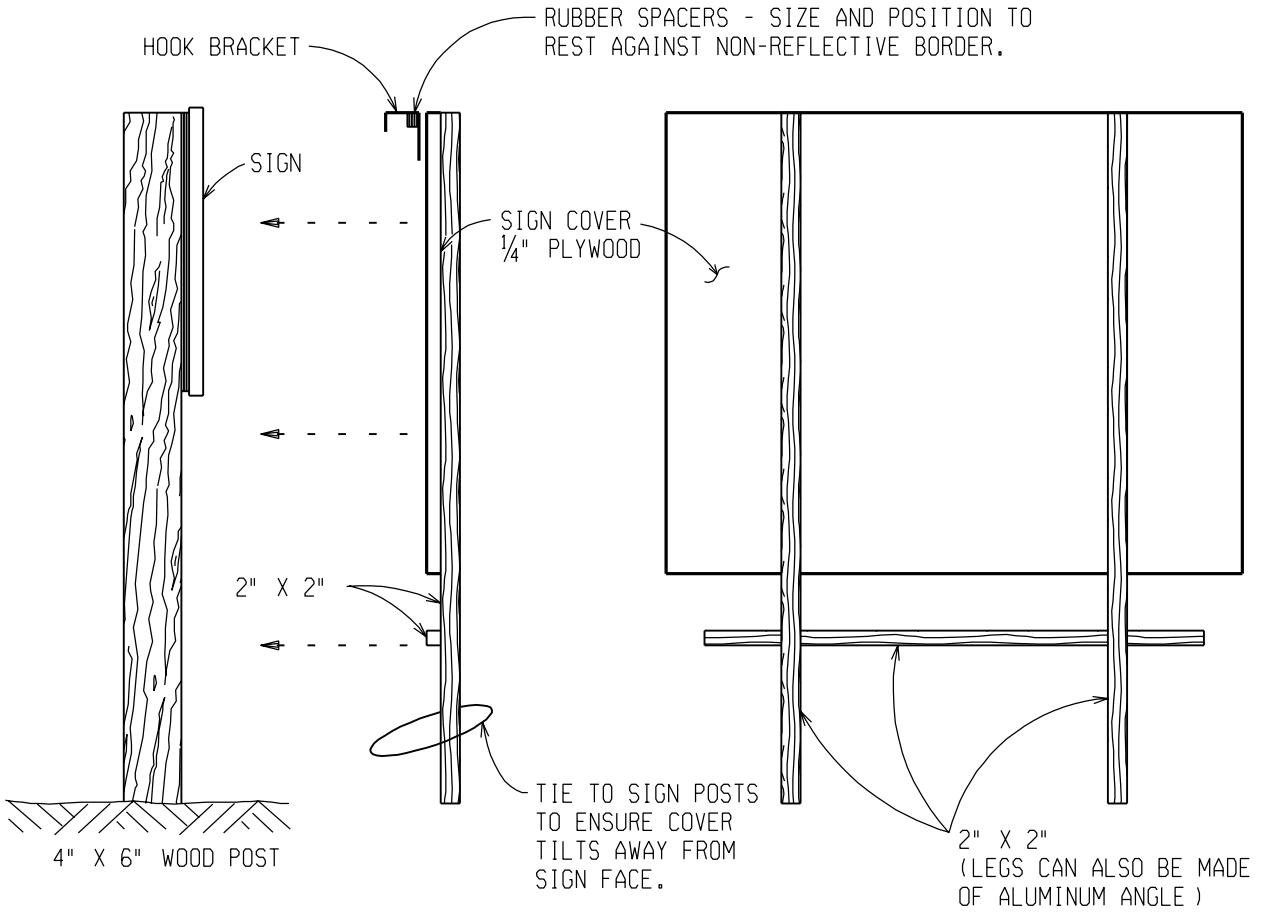
"RAMP WORK AHEAD" SIGN PLACED ALONG FREEWAY MAIN ROADWAYS SHOULD NOT BE CLOSER THAN 400' TO ANY OTHER TRAFFIC SIGN. (MAY NOT BE POSSIBLE IN URBAN AREAS)

DURATION: LONG-TERM STATIONARY, INTERMEDIATE-TERM STATIONARY, SHORT-TERM STATIONARY

MDOT Michigan Department of Transportation

MAINTENANCE DIVISION

TRAFFIC CONTROL PLAN FOR WORK OPERATIONS ON EXIT RAMPS



THIS COVER IS PRIMARILY DESIGNED TO COVER SPEED LIMIT SIGNS ON FREEWAYS. IF YOU ARE TRYING TO COVER ANOTHER KIND OF SIGN, PLEASE CONTACT TSC OR REGION TRAFFIC PERSONNEL.

MDOT Michigan Department of Transportation
MAINTENANCE DIVISION

SIGN COVER

File: md32.dgn
Drawn by:
Revision Date: 06-08-2004

MD-32

TOC

Typ.

DISTANCE BETWEEN TRAFFIC CONTROL DEVICES "D"

"D" DISTANCES	POSTED SPEED LIMIT, MPH (PRIOR TO WORK AREA)									
	25	30	35	40	45	50	55	60	65	70
D (FEET)	250	300	350	400	450	500	550	600	650	700

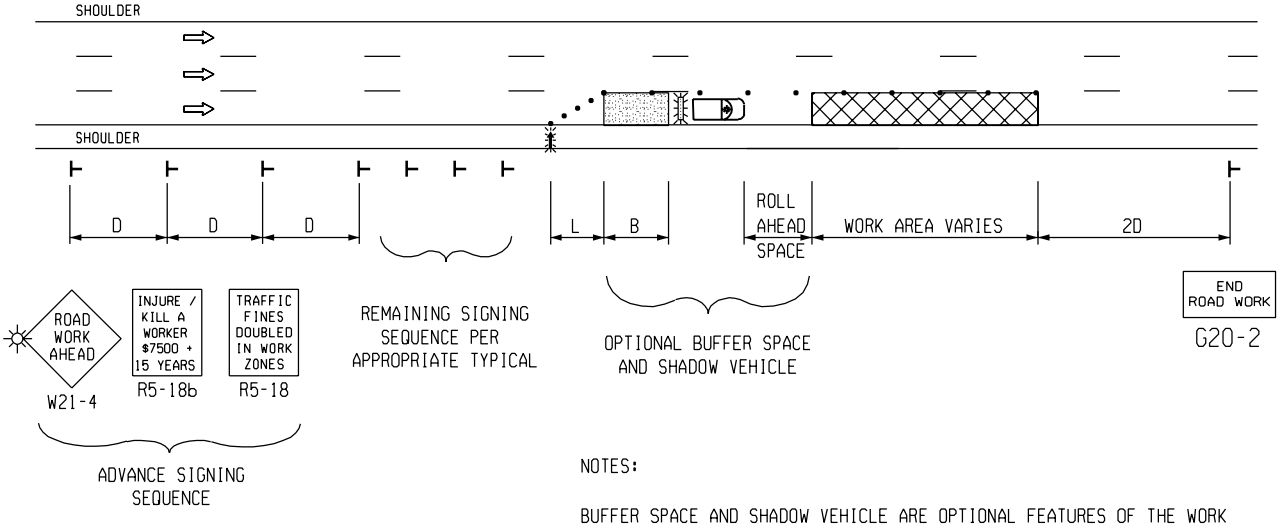
GUIDELINES FOR LENGTH OF LONGITUDINAL BUFFER SPACE "B"

"B" LENGTHS	POSTED SPEED LIMIT, MPH (PRIOR TO WORK AREA)									
	25	30	35	40	45	50	55	60	65	70
B (FEET)	50	83	132	181	230	279	329	411	476	542

MINIMUM MERGING TAPER LENGTH "L" (FEET)

OFFSET	POSTED SPEED LIMIT, MPH (PRIOR TO WORK AREA)										
FEET	25	30	35	40	45	50	55	60	65	70	
8	83	120	163	213	360	400	440	480	520	560	TAPER LENGTH "L" IN FEET
9	94	135	184	240	405	450	495	540	585	630	
10	104	150	204	267	450	500	550	600	650	700	
11	115	165	225	293	495	550	605	660	715	770	
12	125	180	245	320	540	600	660	720	780	840	
13	135	195	266	347	585	650	715	780	845	910	
14	146	210	286	374	630	700	770	840	910	980	
15	157	225	307	400	675	750	825	900	975	1050	

WORK ZONE SETUP



NOTES:

BUFFER SPACE AND SHADOW VEHICLE ARE OPTIONAL FEATURES OF THE WORK ZONE. WHEN USING A SHADOW VEHICLE THERE MUST BE AN APPROPRIATE AMOUNT OF SPACE FOR ROLL AHEAD DISTANCES. SEE TABLE 4 ON PAGE 4 FOR ROLL AHEAD DISTANCES.

Appendix A

Guidelines for Truck Mounted Attenuator Used by Maintenance Forces Working on MDOT Projects

The following guidelines have been developed to provide MDOT maintenance forces guidance on typical applications, equipment and operation of TMAs (Truck Mounted Attenuator). TMAs are devices that are mounted to the rear of a truck which may reduce the impact of a rear-end collision.

Examples of TMA application

TMAs should be considered for use when maintenance operations are conducted where the posted speeds are 45 mph or greater; where personnel and/or equipment occupy a lane customarily used by traffic. Following are other work and traffic scenarios that could warrant the use of a TMA.

- When shadow vehicles are used as a protective vehicle.
- Operations requiring aerial work on scaffolding, lifts, hoists, bucket trucks, etc., that are exposed to moving traffic that require a stationary lane closure. Due to the danger associated with aerial work it is recommended that TMAs be considered for work on roadways with speeds less than 45 mph.
- When conducting moving/intermittent operations such as sign installations, luminaire installations, etc.
- Implementing lane closures, traffic shift operations, painting operations, etc.
- Placing/retrieving traffic control devices related to work zone activities.

Exception: The use of a TMA while performing the installation and maintenance of a traffic signal is not recommended.

Equipment Requirements

TMA

Use only TMAs which have performed successfully when tested as specified in NCHRP 230 or NCHRP 350. When purchasing new TMAs they shall meet NCHRP 350 criteria.

The face of the TMA, visible to approaching traffic shall have high intensity reflectorized alternating yellow and black stripes, similar to the obstacle markers in the MMUTCD.

Vehicle

Stationary Operation: This vehicle shall have a gross vehicle weight of 11.5 tons minimum. The TMA shall be installed on to this vehicle according to the manufactures recommendation. Any material which is loaded onto the vehicle to obtain the required gross weight shall be non-hazardous and must be securely attached to the vehicle as directed by the maintenance supervisor. The TMA shall not be mounted on a lift vehicle that is used in an aerial maintenance operation.

Mobile Operation: This vehicle shall have a gross vehicle weight of 5 tons minimum. The TMA shall be installed on to this vehicle according to the manufactures recommendations. Any materials loaded onto the vehicle shall not be considered part of the vehicles gross weight. Any material loaded onto this vehicle shall be non-hazardous and securely attached to the vehicle.

Operation and Placement of TMAs

Operation

The TMA shall be operated as per manufacturer's recommendations, and/or as directed by the maintenance supervisor. This includes, but is not limited to, the following:

- The height from the bottom of the TMA to the roadway surface shall be 12 inches (+/- 1 inch).
- The TMA shall be parallel (level) with the roadway surface.
- The manufacturers of the approved TMAs recommend a shoulder harness and headrest to be provided for the operator of the TMA vehicle.
- For stationary operations, when operating the vehicle with the attenuator installed, the vehicle shall be in gear if it has a standard transmission (park if an automatic transmission), with the brakes set and steering wheels turned away from the work area and traffic, if possible.

A TMA rated for 45 mph (NCHRP 230 criteria) or 70 km/hr. (NCHRP 350 - Test Level 2) shall be used on non-freeway roadways with a normal posted speed of 55 mph or less; which have been reduced to 45 mph or less. These TMAs shall be prohibited for use on all freeways, non-freeway roadways with posted speed limits of 65 mph or greater and all work zones posted at 50 mph or greater.

A TMA rated for 62 mph (NCHRP 350 - Test Level 3) must be utilized on all freeways, non-freeway roadways with posted speed limits of 65 mph or greater and all work zones posted at 50 mph or greater. These TMAs may also be used on all other roadways.

Placement

Refer to the Maintenance Guidelines: Work Zone Traffic Control for proper placement of the TMA. Additional guidance on the proper placement of TMAs may also be found in the manufacturer's documentation and/or as directed by the maintenance supervisor. In a traffic control operation the TMA vehicle should be the first vehicle encountered by the motorist. Please note that some operations require more than one TMA. The number of TMAs required are based on the number of lanes that are closed. An additional TMA may be used on the shoulder of urban freeways.

The use of a TMA does not eliminate or reduce the requirement for the correct application of traffic control devices and measures outlined in the Maintenance Guidelines: Work Zone Traffic Control. If there is a need or desire to use TMAs in situations not covered in the documents mentioned previously, placement requirements will be as directed by the maintenance supervisor.

TMAs should not be used as an attenuator for a temporary/permanent barrier ending except during barrier installation. Other types of attenuators will provide better and broader attenuation characteristics.

Refer to **Table 1 - Guidelines for Roll-Ahead Distance for TMA Vehicles** for the proper roll-ahead distance of the TMA vehicle.

TABLE 6

Guidelines for Roll-ahead Distance for TMA Vehicles

Weight of TMA Vehicle	**Prevailing Speed (mph)** (Posted Speed Prior to Work Zone)	**Roll-Ahead Distance** (Distance from front of TMA Vehicle to Work Area)
10,000 lbs (Stationary)	60-70 50-55 45	100 ft 75 ft 50 ft
10,000 lbs (Mobile)	60-70 50-55 45	175 ft 150 ft 100 ft
15,000 lbs (Stationary)	60-70 50-55 45	100 ft 75 ft 50 ft
15,000 lbs (Mobile)	60-70 50-55 45	150 ft 125 ft 100 ft
23,000 lbs (Stationary)	60-70 50-55 45	100 ft 75 ft 50 ft
23,000 lbs (Mobile)	60-70 50-55 45	100 ft 75 ft 75 ft